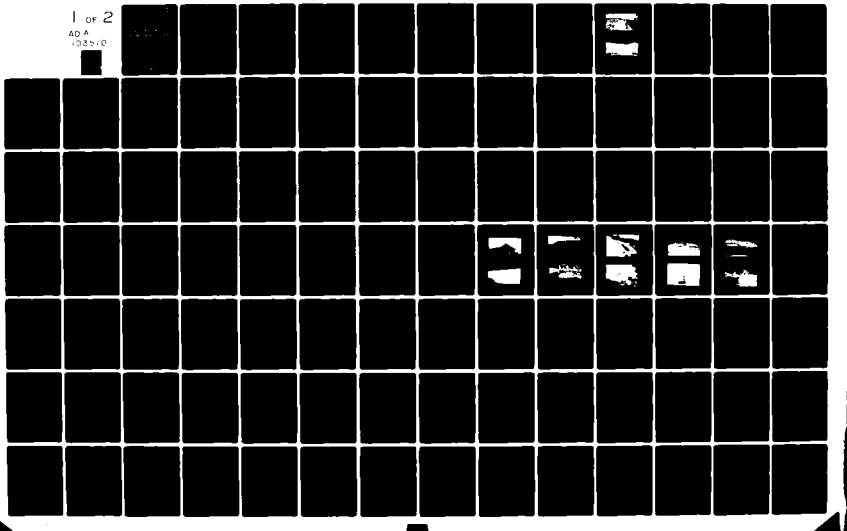
AD-A103 510 ARMY ENGINEER DISTRICT NORFOLK VA F/G 13/13
NATIONAL DAM SAFETY PROGRAM. WHEATLANDS DAM (INVENTORY NUMBER V--ETC(U)
OCT 80 J A WALSH

UNCLASSIFIED NL

1 OF 2
AD A
103510



POTOMAC RIVER BASIN

AD A103510

LEVEL I

Name Of Dam: WHEATLANDS
Location: FREDERICK COUNTY, VIRGINIA
Inventory Number: VA 06913

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM.

Wheatlands Dam. (Inventory Number VA-06913), Potomac River Basin. Frederick County, Virginia. Phase I Inspection Report.

U.S. ARMY CORPS OF ENGINEERS · NORFOLK DISTRICT ·

PREPARED BY

NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

11 OCT [redacted] 80

411030

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Phase I Inspection Report National Dam Safety Program		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U. S. Army Engineering District 803 Front Street Norfolk, Virginia 23510		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE October 1980 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES
Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*
Dams - VA
National Dam Safety Program Phase I
Dam Safety
Dam Inspection

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

711

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Inspection is to indentify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspection. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam appurtenenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

NAME OF DAM: WHEATLANDS DAM
LOCATION: FREDERICK COUNTY, VIRGINIA
INVENTORY NUMBER: VA 06913

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

TABLE OF CONTENTS

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF DAM

Name of Dam:	Wheatlands
State:	Virginia
Location:	Frederick County
USGS Quad Sheet:	Stephens City, Virginia
Stream:	Crooked Run
Date of Inspection:	29 October 1980

Wheatlands Dam is an earthfill structure approximately 680 feet long and 71 feet high. The dam is owned by Mr. J. L. Bowman and F. L. Glaize of Stevens City, Virginia. The dam is classified as an intermediate size dam with a significant hazard classification. The principal spillway is a 72-inch corrugated metal pipe (CMP) serving as a drop-inlet that passes into a 60-inch CMP that passes through the dam at low level. The emergency spillway is an open channel earthen cut left of the left abutment. The reservoir was designed to provide recreation.

Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) is the PMF. The spillways will pass 100 percent of the PMF or 100 percent of the SDF without overtopping the crest of the dam with normal pool established at the present condition. The spillways are adjudged as adequate.

In 1978, the 72-inch CMP drop-inlet was damaged during an ice thaw draining the lake to its present lake level. A portion of the upstream slope eroded as part of that failure.

The visual inspection revealed no problems that required immediate remedial measures. However, a professional engineering consultant should be retained to inspect the 60-inch CMP spillway. It is suspected that damage may have occurred to the pipe when the 72-inch drop-inlet failed. This should be accomplished within 12 months.

There is no regular maintenance program or warning system. It is recommended a maintenance program and warning system be established. The maintenance items listed in Section 7.2 should be accomplished as part of the regular maintenance program within the next 12 months.

If the dam is to be reconstructed to original design conditions, the eroded portions of the upstream slope must be restored. Also a stability analysis for the steady seepage condition is recommended. Plus, the spillway should be checked and redesigned, if necessary, to insure there is no overtopping of the non-overflow section for the PMF.

Submitted By:

Original signed by
JAMES A. WALSH

JAMES A. WALSH, P. E.
Chief, Design Branch

Approved:

Original signed by:
LTC Leonard C. Gregor

for DOUGLAS L. HALLER
Colonel Corps of Engineers
District Engineer

Date: FEB 13 1981

Recommended By

Original signed by
JACK G. STARR

JACK G. STARR
Chief, Engineering Division

EMBANKMENT

RESERVOIR AREA

OVERALL VIEWS WHEATLANDS DAM

29 OCTOBER 1980

SECTION 1

PROJECT INFORMATION

1.1 GENERAL:

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (Reference 1, Appendix VI). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Wheatlands Dam is an earthfill structure approximately 680 feet long and 71 feet high. The crest of the dam is 30 feet wide with a crest elevation of 626 ft. msl. The upstream slope is 2 horizontal to 1 vertical (2H:1V) with riprap protection between elevations 616 and 622. The downstream slope is 2.5H:1V. The embankment is keyed into foundation rock but there are no foundation drains.

The principal spillway is a 72-inch CMP serving as a drop-inlet which passes into a 60-inch CMP running through the dam at low level. The design crest of the principal spillway was elevation 616. Since the ice thaw in March 1978 removed the upper portion of the drop-inlet, the crest of the drop-inlet is at elevation 585. The pipe outlets into a small stilling pond below the dam. The invert elevation of the outlet pipe, which is partially submerged in the stilling pond, is elevation 556.44.

The emergency spillway is an open channel earthen cut left of the left abutment. The crest of the emergency spillway is at elevation 619.75 and is approximately 200 feet wide.

A 24-inch CMP, with an intake elevation of approximately 558, is available for dewatering the reservoir. A butterfly valve, located at the bottom of the 72-inch drop-inlet, when operated, will drain the reservoir.

1.2.2 Location: Wheatlands Dam is located on Crooked Run about 1/2 mile northwest of the intersection of Clarke, Warren and Frederick Counties. A location map is provided in Appendix I.

1.2.3 Size Classification: The dam is classified as an intermediate size structure as defined by Reference 1 of Appendix VI.

1.2.4 Hazard Classification: The dam is located about 1-1/2 miles upstream of Nineveh, Virginia, which has several homes along the stream bank. Therefore, a significant hazard classification is given for this structure according to guidelines contained in Section 2.1.2 of Reference 1, Appendix VI. The hazard classification used to categorize dams is a function of location only and has nothing to do with their stability or probability of failure.

1.2.5 Ownership: Mr. J. L. Bowman and Mr. F. L. Glaize of Stevens City, Virginia.

1.2.6 Purpose: Recreation.

1.2.7 Design and Construction History: The dam was designed by Gilbert W. Clifford and Associates, Inc. The contractor was Whitker Construction, Bayse, Virginia, which was supervised by Soil Consultants, Merrifield, Virginia. The 72-inch CMP principal spillway partially collapsed in March of 1978 when an ice thaw caused the thick ice to crumple the pipe causing the water level in the reservoir to lower from approximately 616 to 585. The wrecked portion of the CMP was removed and placed in the emergency spillway.

1.2.8 Normal Operational Procedures: Water passes automatically through the principal and emergency spillways as the reservoir rises above the spillways crests.

1.3 Pertinent Data:

1.3.1 Drainage Area: The dam controls a drainage area of 3.0 square miles.

1.3.2 Discharge at Dam Site: Maximum flood - A sudden drawdown caused by a partial collapse of the principal spillway in March 1978 allowed the water level in the reservoir to drop 30 feet. Since the drawdown, the reservoir has risen only about 3 feet after a storm.

Pool level at top of dam

Principal Spillway . . . . . 291 cfs
Emergency Spillway . . . . . 8125 cfs

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet msl	Reservoir Capacity Area, acres	Acre, feet	Watershed, inches	Length miles
Top of Dam	626	250	4300	26.9	1.62
Emergency Spillway Crest	619.75	172	3030	18.9	1.56
Principal Spillway Crest (original)	616	142	2410	15.1	1.48
Principal Spillway Crest (Actual)	585	37.6	376	2.4	.78
Streambed at Down - stream toe of dam	555±	-	-	-	-

SECTION 2

ENGINEERING DATA

2.1 Design: The dam was designed by Gilbert W. Clifford & Associates, Inc., Fredricksburg, Virginia. The design data reviewed included the following:

a. As-built drawings, Appendix I. A site investigation was performed along the centerline of the dam, on both abutments and in proposed borrow areas. Exploration consisted of 18 borings. Bag samples and drive spoon sampling were taken in overburden. Double barrel NX core were taken in rock. Permeability tests were also performed in rock in two borings. Boring locations and logs are shown on the drawings.

b. Construction Specifications.

c. Post-construction study performed by Law Engineering Associates of Virginia, McLean, Virginia, Appendix V. Law Engineering performed a post-engineering study to evaluate seepage through the embankment. Major wet areas had developed on the downstream slope. Portions of this study were made available for this report. A site investigation was performed. Exploration consisted of five borings along the centerline of the dam and six test pits on the downstream slope and toe. Disturbed and three undisturbed samples were taken. In four borings, sealed observation wells were installed to monitor water level readings. A phreatic surface through the dam was developed. Soil indices and a classification were performed on several samples. Compression indices, effective PHI angles, and Standard Proctor Moisture-Density values were determined based on soil indices and empirical relationships. A Consolidated-Undrained Triaxial Shear Test was performed on one of the undistrubed sample.

There are no other known available design data or post construction engineering data.

2.2 Construction: The dam was constructed under the direction of Soil Consultants, Inc., Merrifield, Virginia. Available information (Appendix IV) consisted of inspection logs, a moisture-density relationship per Method D, ASTM D-698, and field density tests. There are no other known construction data.

2.3 Evaluation: There is sufficient rudimentary information to assess foundation and embankment conditions. However, there are no stability analyses.

SECTION 3

VISUAL INSPECTION

3.1 Findings:

3.1.1 General: The results of the 29 October 1980 inspection are recorded in Appendix III. At the time of the inspection, the weather was fair and cool. The temperature was 45°-55° F. and the ground conditions were dry. The pool elevation was about 580 feet msl, 26 feet below designed normal pool. The tailwater was at approximately 559 feet msl. There was flow through the principal spillway by way of leakage around the drawdown butterfly valve and through seams in the vertical drop-inlet pipe. A prior inspection report by Law Engineering performed in 1976 is included in Appendix V.

3.1.2 Embankment: The embankment is in good condition. A sketch showing a plan view with inspection comments is provided on Plate I, Appendix III. The crest serves as a dirt road.

There are no signs of surface cracks, unusual movement, sloughing, or misalignment. A portion of the principal spillway riser pipe collapsed during a Spring 1978 ice thaw. The pipe is a spiral wound type corrugated metal. It unraveled during failure creating an eddy current. The current eroded a large portion of the area embankment. Presently, there is a scarp about 20 feet in height with a near vertical face. A road was cut from the left abutment to the riser on the upstream slope about two-thirds down from the crest. (See overall photo provided at the beginning of the report and Photos. No. 2 and 5, Appendix II). There is erosion due to eddy currents and animal burrows around the discharge pipe.

The right upstream and downstream abutments have a dirt road that traverses the contact. The left downstream abutment is buttressed with fill and is well vegetated with grass.

There are two wet spots as identified and described on Plate II, Appendix I. The drawings show a toe drain; however, the owners say no drain was constructed.

The upstream slope is lightly vegetated with field grass and brush. Also there are several Sycamore saplings on the dam. The downstream slope is well vegetated with field grass. The crest is bare. (See Photos. No. 1 and 3, Appendix II).

3.1.3 Outlet Works: As previously noted, the 72-inch CMP riser pipe collapsed in March 1978. The damage was caused by an ice thaw. The principal spillway crest was lowered to approximately 585 from 616. Portions of the metal sheeting unraveled into the outlet pipe. The 72-inch CMP was observed to be leaking at two levels below the crest. A tree limb is resting in the existing drop-inlet crest. (See Photo. #6, Appendix II). The 24-inch

CMP intake pipe is controlled by a butterfly valve at the bottom of the 72-inch drop-inlet principal spillway. The control stem is broken and inoperable. The valve is closed but the seal is leaking. The 60-inch principal spillway outlet is partially submerged. (See Photo. No. 7).

3.1.4 Emergency Spillway: The control section is in natural ground with a few rock outcrops. A severed portion of the damaged 72-inch CMP drop inlet riser (principal spillway) presently sits in the control section. (See Photos. No. 9 and 10). The approach channel is grassed and in good condtion. The discharge channel is steep and heavily wooded.

3.1.5 Instrumentation: There is no instrumentation on the dam.

3.1.6 Reservoir Area: The reservoir slopes are mild. The area above the original pool elevation is heavily wooded. There are no signs of slope failure. There is no shoreline debris. The inspection team was unable to determine if there is a sedimentation problem. No sedimentation was observed or reported. An overall view of the reservoir is provided at the beginning of the report.

3.1.7 Downstream Channel: The downstream channel is narrow and shallow with a wide, flat flood plain. (See Photo. No. 8, Appendix II). Several homes are located in Nineveh, Virginia, about 1.5 miles downstream.

3.1.8 Evaluation: Overall the dam appears in good condition. However, it is suspected that damage may have also occurred to the 60-inch CMP principal spillway when the 72-inch riser pipe failed. A professional engineering consultant should be retained to inspect the pipe for integrity. Also the visual inspection revealed certain preventive maintenance items which should be scheduled as part of an annual maintenance program. These are:

a. Vegetative cover should be established on the scarp by the 72-inch riser-pipe to protect the exposed embankment from erosion.

b. Riprap should be placed around the discharge end of the 60-inch principal spillway to protect the downstream toe from further erosion from discharge flow eddy currents. The animal burrows around the pipe should also be backfilled and seeded.

c. Cut all brush and trees on the embankment to the ground.

d. The unraveled corrugated metal in the 72-inch riser pipe should be removed. Also the tree limb resting on the intake should be removed and the invert equipped with a trash rack to prevent further damage due to debris.

e. The damaged control stem to the emergency gate should be repaired and made operable.

f. The severed portions of 72-inch CMP in the emergency spillway should be removed. Trees in the discharge channel should be thinned to reduce the potential for debris to collect and dam flows through the spillway.

g. A staff gage should be placed in the reservoir area to visually monitor pool elevations.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures: The original design normal pool was established at elevation 616. Because of the failure of the principal spillway drop-inlet in March 1978, the reservoir is now controlled by the 72-inch CMP crest at approximately elevation 585. The reservoir provides minimum recreation. Water passes automatically through the principal spillway as the water level rises above the principal spillway crest. Water will also pass automatically through the emergency spillway when the water level in the reservoir rises above elevation 619.75. A 24-inch emergency drawdown butterfly valve is located in the principal spillway intake structure.

4.2 Maintenance: There is no regular maintenance program.

4.3 Warning System: At present time, there is no warning system or evacuation plan for Wheatlands Dam.

4.4 Evaluation: The dam does not require an elaborate operational and maintenance program. However, a regular maintenance program should be initiated and documented. An emergency operation and warning plan should be developed. It is recommended that a formal emergency procedure be prepared and furnished to all operating personnel. This should include:

a. How to operate the dam during an emergency.

b. Who to notify, including public officials, in case evacuation from the downstream area is necessary.

SECTION 5

HYDRAULIC/HYDROLOGIC DATA

5.1 Design: None were available.

5.2 Hydrologic Records: None were available.

5.3 Flood Experience: The maximum flow at the dam site is not known.

5.4 Flood Potential: The 100 Year Flood, 1/2 PMF, and PMF were developed and routed through the reservoir by use of the HEC-1DB computer program (Reference 2, Appendix VI) and appropriate unit hydrograph, precipitation and storage-outflow data. Clark's Tc and R coefficients for the local drainage area were estimated from basin characteristics. The rainfall applied to the developed unit hydrograph was obtained from U. S. Weather Bureau Publications (References 3 and 4 of Appendix VI).

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1.

Water passes automatically through the principal and emergency spillways as the reservoir rises above the spillways crests.

The storage curve was developed based on areas obtained from a U. S. Geological Survey Quadrangle Map. Rating curves for the principal spillway, emergency spillway, non-overflow section of dam and the drawdown outlet were developed. In routing hydrographs through the reservoir, it was assumed that the initial pool level was at the principal spillway crest. Two tables, 5.1 and 5.2, show the principal spillway at elevation 616.0 (original design) and 585 (present condition).

5.6 Overtopping Potential: The probable rise in the reservoir and other pertinent information on reservoir performance is shown in the following table:

Table 5.1 RESERVOIR PERFORMANCE (original design)

Item	Normal Flow	100 1/ Year	1/2 PMF	PMF 2/
Peak flow c.f.s.				
Inflow	3	3062	8732	17464
Outflow	3	2605	3380	11611
Maximum elevation				
ft. msl	616	617.31	623.03	626.75
Non-overflow section (el 626.0)				
Depth of flow, ft	-	-	-	.75
Duration, hrs	-	-	-	2.0
Velocity, fps 3/	-	-	-	4.1
Tailwater elevation				
ft. msl.	559±	-	-	-

Table 5.2 Reservoir Performance (present condition)

Item	Normal Flow	100 1/ Year	1/2 PMF	PMF 2/
Peak flow c.f.s.				
Inflow	3	3062	8732	17464
Outflow	3	127	257	5939
Maximum elevation				
ft. msl	585	594.5	617.93	624.54
Non-overflow section (el 626.0)				
Depth of flow, ft	-	-	-	-
Duration, hrs	-	-	-	-
Velocity, fps 3/	-	-	-	-
Tailwater elevation				
ft/ msl	559±	-	-	-

1/ The 100 Year Flood has one chance in 100 of occurring in any given year.
2/ The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.
3/ Critical Velocity

5.7 Reservoir Emptying Potential: A 24-inch gated outlet at elevation 556 ft. msl is available for dewatering the reservoir. The low level opening through the intake structure will permit withdrawal of about 65 cfs with the reservoir at present normal pool (585) and essentially dewater the reservoir in less than 6 days. This is equivalent to an approximate drawdown rate of 3.3 feet per day based on the hydraulic height measured from normal pool divided by the time to dewater the reservoir.

5.8 Evaluation: Based on the size (intermediate) and hazard classification (significant) the recommended Spillway Design Flood is 1/2 PMF to the PMF. Because of the risk involved, the PMF has been selected as the SDF. The spillways will pass the PMF without overtopping the crest of the dam under the present conditions of the storage pool.

Conclusions pertain to present day conditions. The effect of future development on the hydrology has not been considered.

SECTION 6

DAM STABILITY

6.1 Foundation and Abutments: Wheatlands dam is located within the Valley and Ridge province of the Appalachian Highlands. The bedrock in the area of the dam consists of fissile clay-shale identified as the Martinsburg Formation of Ordovician Age. Outcrops of the Martinsburg are bluish gray but turn to yellow on weathering due to oxidation of the ferruginous constituents in the shale. The Martinsburg shale is believed to mark the trough of the Massanutten Synclinorium, one of the major geologic structures of the Valley of Virginia.

Borings performed both by Gilbert Associates and Law Engineering encountered brown decomposed shale to medium hard to hard fracture gray shale. Permeability tests performed by Gilbert indicated the rock to be relatively tight. Rock outcrops on the downstream right abutment and in the emergency spillway consist of thinly bedded, blue and oxidized yellow shale. The abutment outcrops strikes N30W with a near vertical dip. The spillway outcrop also strikes N30W with a vertical dip. The strikes are near perpendicular to the axis of the dam. The dam axis is N85°E.

The drawings show the dam is keyed into rock. Soil Consultants Inc., directed construction and records are in Appendix IV. The core starts at elevation 540.0± and extends to elevation 616.0±. The width is 25 feet and tapers to 10 feet with elevation. The drawings also show a foundation toe drain. The construction logs recommend that the rock toe drain should be installed. However, the owners reported that no drain was installed.

Law Engineering conducted a post-construction study (Appendix V) to evaluate wet spots that had developed on the downstream slope. The pool level at the time of their study was elevation 599. The present pool level is 18 feet lower and no wet spots were observed during the visual inspection in the areas noted by Law.

The visual inspection did reveal additional wet spots not noted in Law's report. One spot is located at the left downstream toe adjacent to the left abutment and extends into the downstream area. The left downstream abutment is a fill to channel emergency spillway flows away from the toe. A second wet spot is located 10 feet up the slope from the discharge pipe. It is suspected the wet spots are due to flow through the embankment existing in the slope, because there is no foundation drain. However, flow through the foundation is possible. Even though permeability tests indicate tight conditions, the bedding is near perpendicular to the dam axis. This condition encourages seepage by providing near direct flow channels through the dam. This has been a problem with another dam in the Winchester Area with similar foundation conditions.

6.2 Embankment:

6.2.1 Materials: The contract drawings show an earth embankment with a central cutoff core. As per a Soil Consultants inspection report (March 4, 1976 letter), the embankment has a silty clay core with a silty clay and shale zone on the upstream side and more shaley material on the downstream side.

Borings B-1 through B-4 were performed by Law Engineering along the centerline of the dam. These borings were drilled through the core and show embankment material to be a clayey silt and silty gravel with shale fragments. Soil classifications ranged from (GM) to (ML). Wet unit weights were in the order of 123.1 to 134.0 PCF. Natural moistures ranged from 15.8 to 30.6 averaging 21.1%. Atterberg limits varied very little with an average LL = 40 and PI = 12. A Consolidated-Undrained Triaxial Shear Test was run on an undisturbed soil sample. The following shear parameters were determined:

	PHI	C
Total Stress	17o	0.2 KSF
Effective Stress	23o	0.3 KSF

Test specifications had an average initial saturation of 87 percent with an average wet unit weight of 123.1 PCF.

Borrow areas are not designated on the drawings. However, five borings (P-11 through P-14, and B10) were performed in the immediate reservoir by Gilbert & Associates during design. These borings encountered clayey silt with shale fragments classified as (CL). The classifications on the drawings indicate soil property tests were performed. However, no data is available. The material is relatively the same encountered by Law Engineering's borings and was more than likely the designated borrow source. Borings along the centerline of the dam and in the emergency spillway indicate excavated materials to be the same nature.

The specifications required fill to be compacted to at least 95 percent Method D, ASTM D-698. The maximum layer-thickness after compaction shall be 9-inches and the moisture content shall be within optimum moisture plus or minus 2 percent.

Soil Consultants performed three proctors, each representing three portions of the dam, the upstream slope (designated Front), the central core (Core), and the downstream slope (Back). The follow moisture-density parameters were determined:

	Dry Density	Optimum Moisture
Upstream Slope	106.4 PCF	18.0%
Central Core	94.1	25.0
Downstream Slope	117.4	12.8

Field densities were performed to monitor compaction. Overall compaction was 100.2 percent. Approximately 54 percent of the tests exceeded 100 percent compaction.

6.2.2 Stability: There are no stability calculations. The dam is 71 feet high and 340 feet wide. The upstream slope is 2H:1V and the downstream slope is 2.5H:1V. The dam was designed for a normal pool elevation of 616. As a result of the damaged intake structure, the present normal pool is at elevation 580. The maximum storage pool is 619.75, the elevation of the emergency spillway. The upstream slope experienced a sudden drawdown during the collapse of the riser without experiencing any detrimental effects.

As part of Law's Study, observation wells were installed in four borings and a phreatic surface was developed. The pool level at the time of their study was elevation 599. Flow is shown to exit the downstream slope at elevation 575. The present pool is 18 feet lower and no wet spots were observed during the visual inspection in the areas noted by Law. The two wet spots observed during the visual inspection had an approximate elevation of 568.6 for the one by the left abutment and 566.7 for the one above the discharge pipe.

6.2.3 Seismic Stability: The dam is located in Seismic Zone 2. Therefore, according to the Recommended Guidelines for Safety Inspection of Dams, (Reference 1, Appendix VI,), the dam is considered to have no hazard from earthquakes provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: There is insufficient information to adequately evaluate the stability of the dam. The dam is engineered but there are no stability calculations. However, visual inspection revealed no instability problems. Also, the upstream slope experienced a sudden drawdown without any detrimental effects.

Under present pool conditions the embankment is more than adequate. Therefore, in light that the dam is engineered, the visual inspection revealed no problems, and the size of the embankment for the present pool, a stability check is not required. Overtopping is not a problem because the spillways can pass the design flood.

However, if the dam is to be reconstructed, the eroded portions of the upstream slope must be restored. Also in light of the wet spots on the downstream slope and no foundation drain, a stability analysis for the steady seepage condition is recommended. Also the spillways should be checked and redesigned, if necessary, to insure there is no overtopping the non-overflow section.

Field densities were performed to monitor compaction. Overall compaction was 100.2 percent. Approximately 54 percent of the tests exceeded 100 percent compaction.

6.2.2 Stability: There are no stability calculations. The dam is 71 feet high and 340 feet wide. The upstream slope is 2H:1V and the downstream slope is 2.5H:1V. The dam was designed for a normal pool elevation of 616. As a result of the damaged intake rises, the present normal pool is at elevation 580. The maximum storage pool is 619.75, the elevation of the emergency spillway. The upstream slope experienced a sudden drawdown during the collapse of riser without experiencing only detrimental effects.

As part of Law's Study, observation wells were installed in four borings and a phreatic surface was developed. The pool level at the time of their study was elevation 599. Flow is shown to exit the downstream slope at elevation 575. The present pool is 18 feet lower and no wet spots were observed during the visual inspection in the areas noted by Law. The two wet spots observed during the visual inspection had approximate elevation of 568.6 for the one by the left abutment and 566.7 for the one above the discharge pipe.

6.2.3 Seismic Stability: The dam is located in Seismic Zone 2. Therefore, according to the Recommended Guidelines for Safety Inspection of Dams, (Reference 1, Appendix VI,), the dam is considered to have no hazard from earthquakes provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: There is insufficient information to adequately evaluate the stability of the dam. The dam is engineered but there are no stability calculations. However, visual inspection revealed no instability problems. Also, the upstream experienced a sudden drawdown without any detrimental effects.

Under present pool conditions the embankment is more than adequate. Therefore, in light that the dam is engineered, the visual inspection revealed no problems, and the size of the embankment for the present pool, a stability check is not required. Overtopping is not a problem because the spillways can pass the design flood.

However, if the dam is to be reconstructed, the eroded portions of the upstream slope must be restored. Also in light of the wet spots on the downstream slope and no foundation drain, a stability analysis for the steady seepage condition is recommended. Also the spillways should be checked and redesigned, if necessary, to insure there is no overtopping the non-overflow section.

SECTION 7

ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: There is sufficient rudimentary information to assess foundation and embankment conditions, but no stability calculations. The visual inspection revealed no findings that proved the dam to be unsound. There is no regular maintenance program and warning system. However, the dam is in good condition and there is no immediate need for remedial measures. Corps guidelines indicate the appropriate Spillway Design Flood (SDF) for an intermediate size significant hazard dam is the PMF. The spillway will pass the PMF without overtopping the crest of the dam under the present condition of pool storage. Overtopping is not a problem because the spillway can pass the design flood. A stability check is not required.

7.2 Recommended Remedial Measures: It is recommended that a regular maintenance program be established and documented. A formal emergency procedure should be prepared and furnished to all operating personnel. This should include how to operate the dam during an emergency, and who to notify including public officials, in case evacuation from the downstream area is necessary. Also a professional engineering consultant should be retained to inspect the 60-inch diameter principal spillway. It is suspected that damage may have occurred to the pipe when the 72-inch riser pipe failed. This should be accomplished within 12 months.

The inspection revealed the following maintenance items that should be scheduled by the owner during a regular maintenance period within the next 12 months.

a. Vegetative cover should be established on the scarp by the 72-inch riser-pipe to protect the exposed embankment from erosion.

b. Riprap should be placed around the discharge end of the 60-inch principal spillway to protect the downstream toe from further erosion from discharge flow eddy currents. The animal burrows around the pipe should also be backfilled and seeded.

c. Cut all brush and trees on the embankment to the ground.

d. The unraveled corrugated metal in the 72-inch riser pipe should be removed. Also the tree limb resting on the intake should be removed and the invert equipped with a trash rack to prevent further damage due to debris.

e. The damaged control stem to the emergency gate should be repaired and made operable.

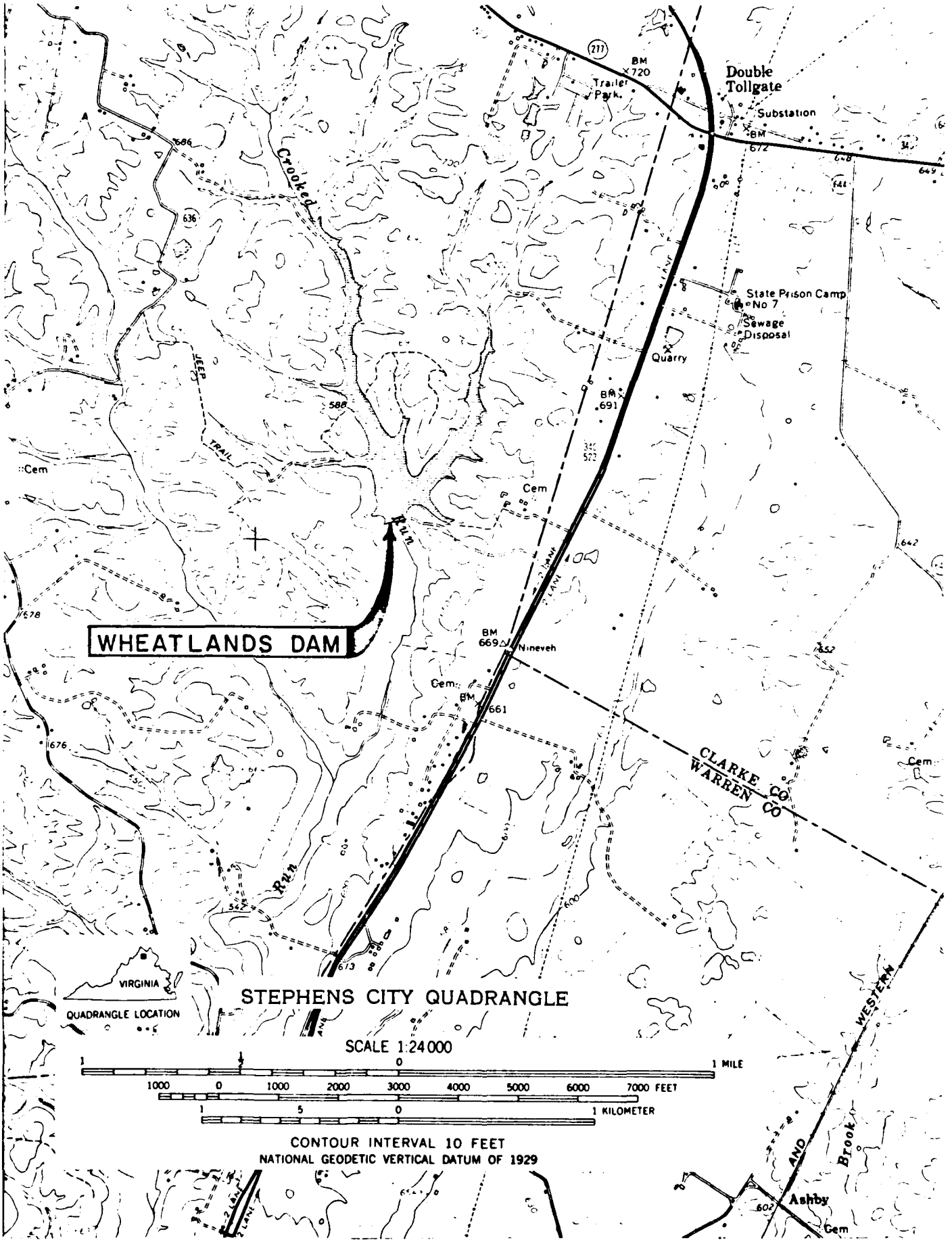
f. The severed remnants of 72-inch CMP in the emergency spillway should be removed. Trees in the discharge channel should be thinned to reduce the potential for debris to collect and obstruct flows through the spillway.

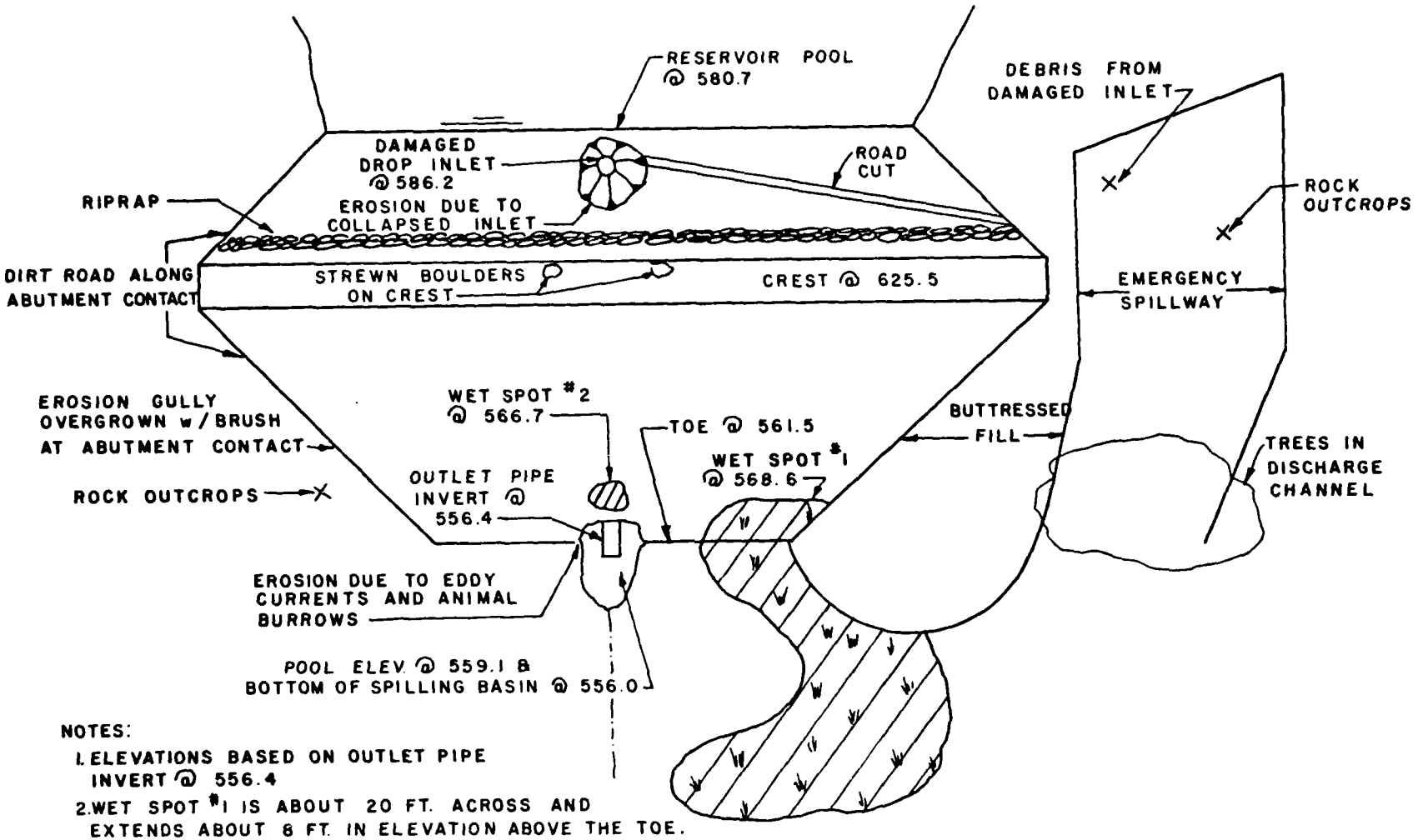
g. A staff gage should be placed in the reservoir area to visually monitor pool elevations.

If the dam is to be reconstructed to original design conditions, the eroded portions of the upstream slope must be restored. In light of the wet spots on the downstream slope and no foundation drain, a stability analysis for the steady seepage condition is recommended. The spillways should be checked and redesigned, if necessary, to insure there is no overtopping the non-overflow section for the PMF.

APPENDIX I

MAPS AND DRAWINGS


WHEATLANDS DAM
Double Tollgate
Substation
Trailer Park
BM 720
BM 672
State Prison Camp No 7
Sewage Disposal
Quarry
BM 691
BM 669
Nineveh
BM 661
Crooked Run
Run
JEEP TRAIL
Cem
CLARKE CO
WARREN CO
Ashby
Brook
WESTERN
AND
VIRGINIA
QUADRANGLE LOCATION
STEPHENS CITY QUADRANGLE
SCALE 1:24000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929



NOTES:

1. ELEVATIONS BASED ON OUTLET PIPE INVERT @ 556.4
2. WET SPOT #1 IS ABOUT 20 FT. ACROSS AND EXTENDS ABOUT 6 FT. IN ELEVATION ABOVE THE TOE. THE SPOT SUPPORTS SWAMP LIKE VEGETATION. THE WET SPOT EXTENDS ABOUT 100 FT. DOWNSTREAM, HARBORS SWAMP LIFE GROWTH AND HAS STANDING WATER.
3. A SECOND WET SPOT IS LOCATED ABOUT 10 FT. UP FROM THE DISCHARGE PIPE. THE SPOT IS ABOUT 7' ROUND.

FIELD SKETCH

WHEATLANDS DAM

FREDRICK, CO. VA.

29 OCTOBER 80

N.T.S.

PLATE I

APPENDIX III

WHEATLANDS
EARTH DAM

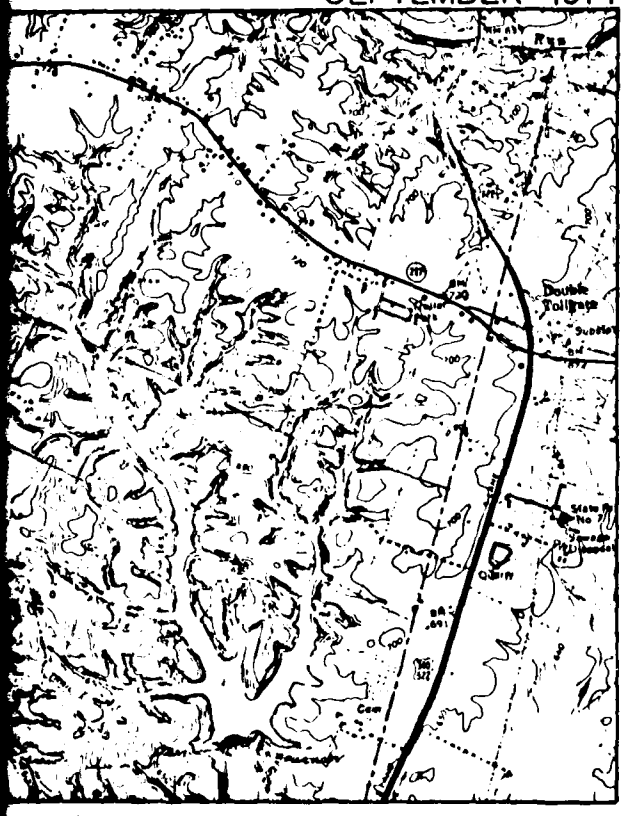
FREDERICK COUNTY SEPTEMBER 1974

LOCATION MAP
Scale 1"=1000'

GILBERT W. CLIFFORD & ASSOCIATES, IN
ENGINEERS & LAND PLANNERS
FREDERICKSBURG, VIRGINIA

ATLANDS
TH DAM

SEPTEMBER 1974



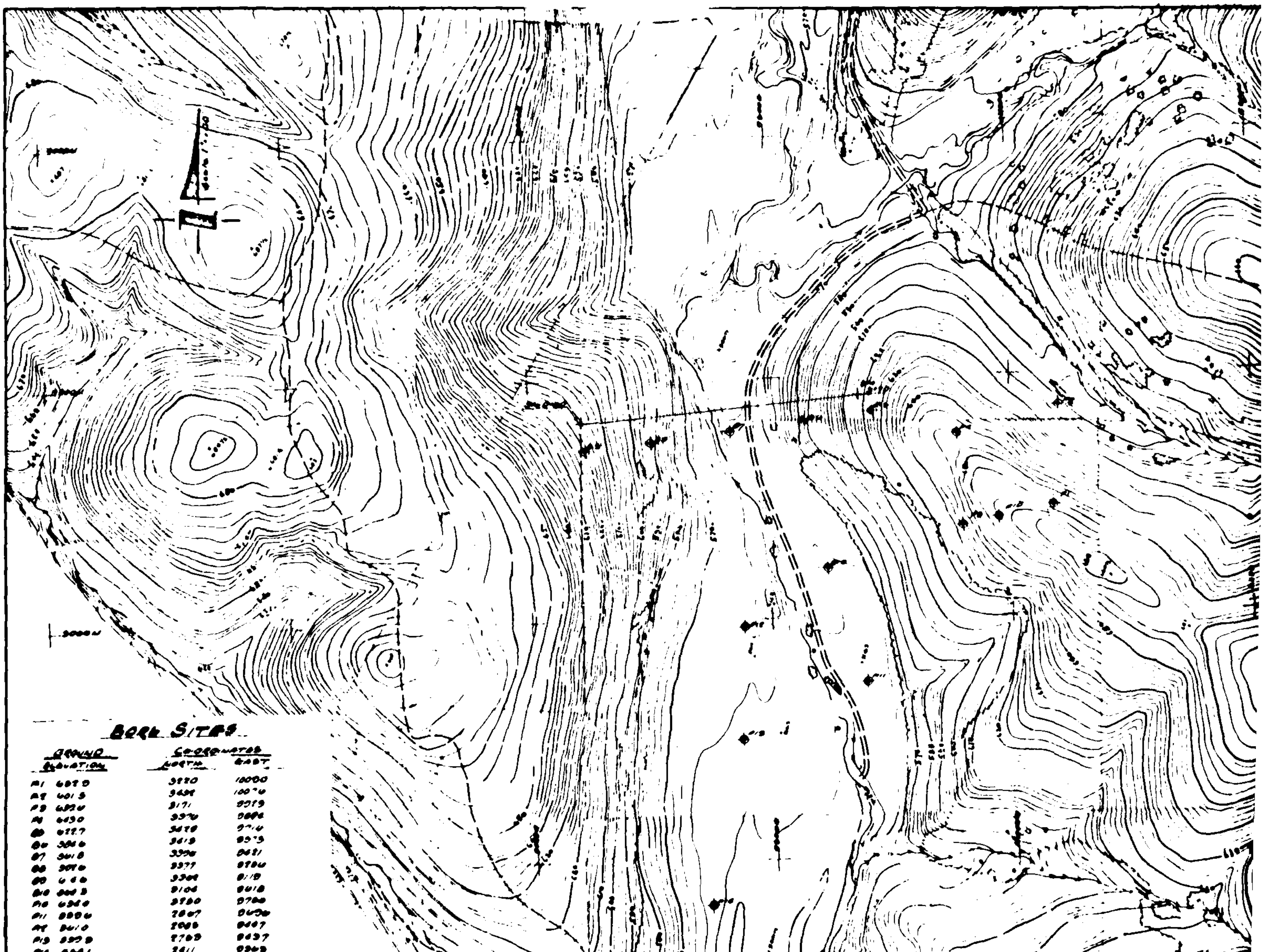
LOCATION MAP

FORD & ASSOCIATES, INC.
ERS & LAND PLANNERS
FREDERICKSBURG, VIRGINIA

Construction supervision supplied by Soil Conservation Service 2000 Juniper Street Marshall Va 22115

March 1976

12



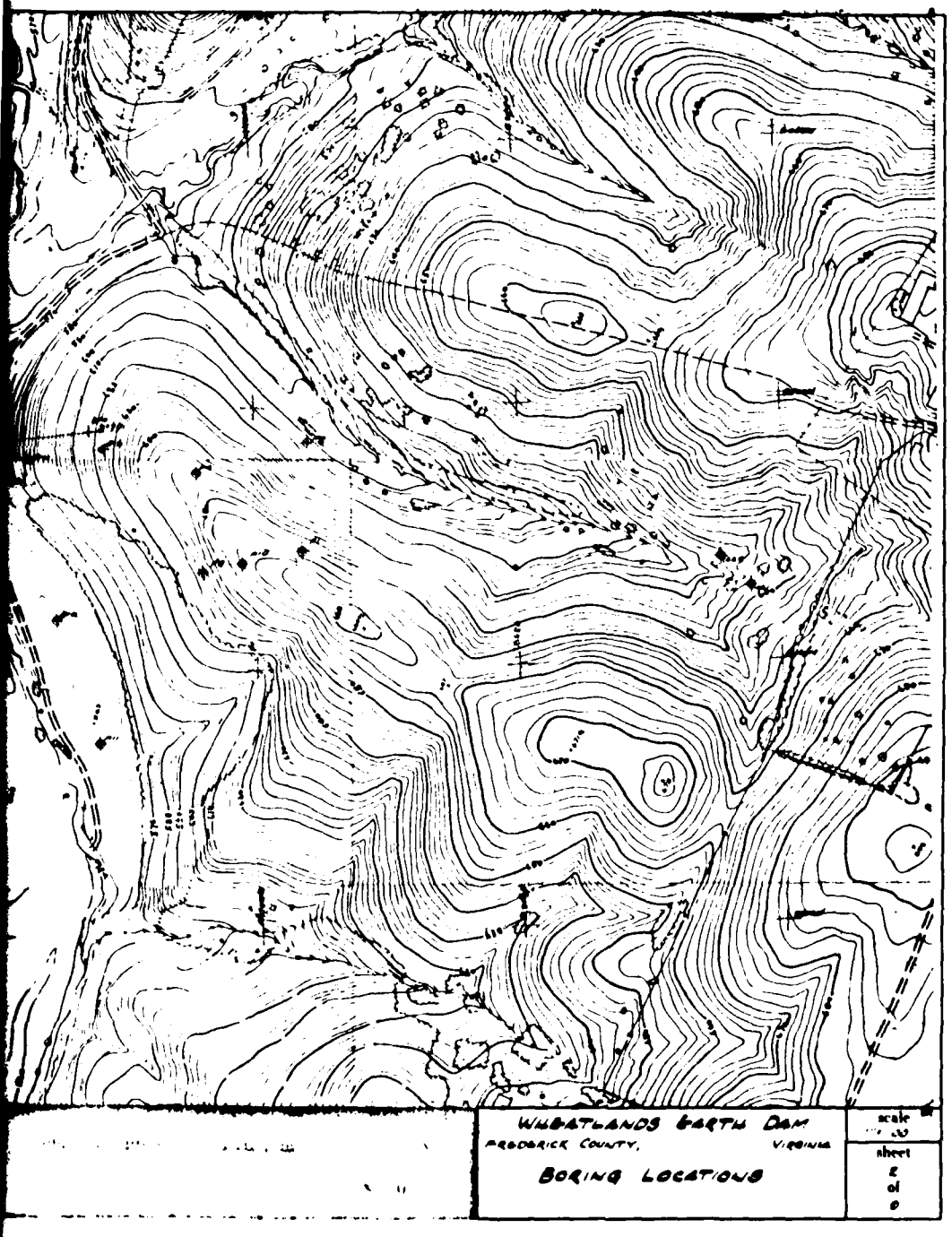
BORE SITES

GROUND ELEVATION		COORDINATES NORTH	EAST
P1	6070	3920	10000
P2	6015	3491	100?6
P3	6926	3171	9919
P4	6430	3370	9886
P5	6227	3470	97?6
P6	3866	3619	9573
P7	3618	3390	8421
P8	3070	3377	8706
P9	6 6 6	3306	8119
P10	8063	3106	8618
P10	6366	3780	9706
P11	8006	2867	8636
P12	3610	2086	8607
P13	8579	2709	8637
P14	8861	2411	0369
AA1	6960	3140	10040
AA2	6970	3100	10009
SH P40	6100	3610	9118
SH P70	6100	9660	9069

REVISIONS description	by	chk
[illegible]	[illegible]	
Note: [illegible] [illegible] data supplied by [illegible] CONSULTANTS P.O. Box [illegible] [illegible]		

job number 7479-3
date Sept. 1976
designed by [illegible]
drawn by [illegible]
approved by

PRE[illegible]



WHEATLANDS EARTH DAM
FREDERICK COUNTY, VIRGINIA
BORING LOCATIONS

scale
sheet

Test Hole	Top Elev.	Depth	No.	Type	Log	Sample Blows	Classification Physical Condition	Remarks
A-1 7/1978	6860	0					Brown Silty Top Soil	
					2.0			End boring at 2.0'
		2.0					Gray sandy silt some gravel rock at 2.0	
		2.0'						
A-2 7/1978	6850	0					Brown, Sandy Topsoil	
					1.0			
							Gray Sandy silt weathered	
		2.0			2.0			
		2.0					Gray Shale	End boring at 2.0'
A-3 7/1978	6869	0					Brown Silty Topsoil	
					1.0			
		5.0					Brown, Silt, Trace of Gravel	Gray Samples 4-6 A-6 (1) SC
		10.0			10.0			
							Brown Silty Sand w/ Gravel Rock at 13.0'	
		15.0			15.0			End boring at 15.0'
A-4 7/1978	6865	0			0'		Spotted Brown Silty Topsoil	
							Brown Cemented silt w/ Shale fragments	Bag Samples 1-3 A-7-6 (19) CL
		5.0			5.0			
							Gray & Brown weathered Shale Hard Gray Shale at 7.0'	End boring at 7.0
A-5 7/1978	6860	0					Brown Silty Topsoil	
					1.0			
							Brown Silt Trace Gravel	
		5.0					Red Gray Shale @ 18.0'	
		10.0						
					15.0			End boring at 15.0
A-6 7/1978	6850	0					Brown Silty Topsoil	
					1.0			
							Brown Silt w/ Shale Gravel	Bag Samples A-6 (6) ML
		5.0						
							Rock @ 17.0'	
		10.0						
					17.0			End boring at 17.0
B-1 7/1978	6867	0					Brown Silty Topsoil	
		1.0			1.0			
		2.5	1	SS		8-8-8	Brown Clayey Silt with some shale fragments (CL)	
		5.0			5.0			
		7.0	2	SS		10-9-10 N=19	Gray weathered Shale	
					8.0			
		9.5	3	SS		100/6"	Gray hard Shale	End boring at 10.5'
B-2 7/1978	6860	0					Gray Shale Fragments	
		1.0						
		2.5	1	SS		8-10-8 N=18		
		5.0			5.0		Blue Shale	
		7.0	2	SS	7.0	Rec. 1.0 or 50%		
							Brown Fractured Shale	
		10.0						
		12.0	3	SS	12.0	Rec. 2.0 or 33%		
								End boring at 15.0'
		15.0					Blue Shale	Perm 5.0 no water into 15.0'

Test Hole	Top Elev.	Depth	No.	Type	Log	Sample Blows	Classification Physical Condition	Remarks
B-3 7/1978	6868	0					Brown Silty Topsoil	
		1.0			1.0		Brown Silt Trace, fine sand Organic matter (ML)	
		2.5	1	SS	2.5	3-5-8 N=13	Brown & Gray Clayey Silt Trace Shale Fragments (CL)	
		5.0						
		7.0	2	SS		5-8-10 N=18		
		10.0			10.0			
		12.0	3	SS		8-10-12 N=22	Gray & Brown Weathered Shale	Encountered Water at 10'
		15.0			15.0			
		17.0	4	SS		50/4"	Gray Hard Shale	End boring at 17.0'
B-4 7/1978	6865	0					Brown Silty Clay	
		1.0	1	SS		4-6-8 N=14		
		2.5			2.5			
		3.5	2	SS		6-10-12 N=22		
		5.0						
		7.0	3	SS	7.0	50/0"	Brown Weathered Shale	Water Level @ completion 6.0'
		8.0	4	SS		100/4"		
		10.0			10.0			
		10.5	5	SS		50/2"		
		12.0	6	SS	12.0	Rec. 2.0 or 100%	Lime Shale	
		15.0			15.0			
		15.5	7	SS		Rec. 3.0 or 60%		
		17.0			17.0			End boring at 17.0
B-5 7/1978	6860	0					Brown S½ Clay Weathered	
		1.0			1.0			Permeability .170 3 minutes 8 Psi 10 Head
		2.5	1	SS	2.5	10-12-13 N=25		
		5.0					Brown Weathered Shale	
		7.0	2	SS	7.0	45/10"		
		10.0			10.0			
		12.0	3	SS	12.0	Rec. 4.0 or 80%		
		15.0			15.0			Permeability 170 Gallon 1 ft Head 8 minutes
		17.0	4	SS	17.0	Rec. 0.8 or 80%	Blue Shale at 17.0	
		17.0			17.0			End boring at 17.0
P-1 7/1978	6860	0					Brown Silty Fine Sand Trace Organic Matter (ML)	Encountered Water at 15.0
		5.0			5.0			
		8.5					Brown Clayey Silt Saturated at 8.0 with some shale fragments (CL)	
		10.0			10.0			Bag Samples 6-10 A-7-6 (10) ML
		15.0			15.0		Gray Hard Shale	End boring at 15.0'
P-2 7/1978	6869	0					Brown Clayey Silt w/ Shale Fragments	Encountered Water at 8.0
		5.0					Brown Silty Clay Saturated	Water Level at completion 9.0
		10.0			10.0			
		12.0			12.0		Gray Weathered Shale Hard Gray Shale at 12.0	End boring at 12.0
P-3 7/1978	6860	0					Brown Sandy Silt Trace Trace Gravel	
		5.0			5.0		Brown Clayey silt with Shale Fragments (CL)	Encountered Water at 8.0
		8.5			8.5			
		10.0			10.0		Brown Clayey silt with Shale Fragments (CL)	Bag Samples 8-10 A-6 (8) CL
		15.0						Water level at completion 8.5

Test Hole	Top Elev.	Depth	No.	Type	Log	Sample Blows	Classification Physical Condition	Remarks
P-3 Cont.								
		15.0			15.0			
P-4 7/1978	6865	0						
		5.0			5.0			
		8.5			8.5			
P-5 7/1978	6868	0						
		5.0			5.0			
		8.5			8.5			
P-6 7/1978	6865	0						
		5.0			5.0			
		8.5			8.5			

REVISIONS

No.	Date	Description	By	Chkd.
1	7/78	Revised Alignment		
		Added 8 Test Hole data supplied by Soil Consultants P.O. Box 66 Mount Vernon, Va. 22121		

job number 7423-3
date SEPT 1978
designed by GWC
drawn by JR
approved by

A-000845

Remarks	Test No.	Top Elev.	Depth	Min	Type	Log	Sample Blows	Classification Physical Condition	Remarks
	B-15 Cont							Brown Clayey Silt w/ Shale Fragments (SM)	
			-40-			-40-		Gray Hard Shale	End Boring at 42'
	B-16	8003	0					Brown Sandy Silt Mass, Topsoil (ML)	
						-50-		Brown Clayey Silt with Shale Fragments (ML)	Dry Sample @ 1.5' & 4.0 (-) 0C
Encountered water at 10'			-50-						
End Boring at 100'						-50-		Gray Weathered Shale (SH) Hard Gray Shale at 15.0'	End of Boring at 100'
			-100-						
	B-17	8001	0			-100-		Brown Clayey Silt with Some Shale Fragments (CL)	
	Top							Hard Gray Shale at 5.0'	End of Boring at 6.0'
Water Level @ completion 5.0'	B-18	8003	0					Brown Clayey Silt	
			-50-			-50-			
End Boring at 75.0									
Encountered 170 Blows/6" 5.0 to 7.0 feet			-100-					Highly Weathered Shale	Boring at 85.0'
Encountered 270 Blows/6" 8.0 to 10.0 feet			150	1st Run	00	-150-	Run 3.0' or 60%	Brown Shale Clay Seams	
End Boring at 170			200	2nd Run	00	-200-	Run 5.0' or 100%	Dark Shale	
Encountered Water at 10.0			-250-			-250-			End Boring at 255'
Dry Sample 0.0 to 2.5 (SM)									
End Boring at 100									
Encountered Water at 0.0									
Water Level at Completion 2.0									
End Boring at 150'									
Encountered Water at 0.0									
Dry Sample 0.0 to 2.5' (SM) Water level at completion 0.0									

WETLANDS EARTH DAM

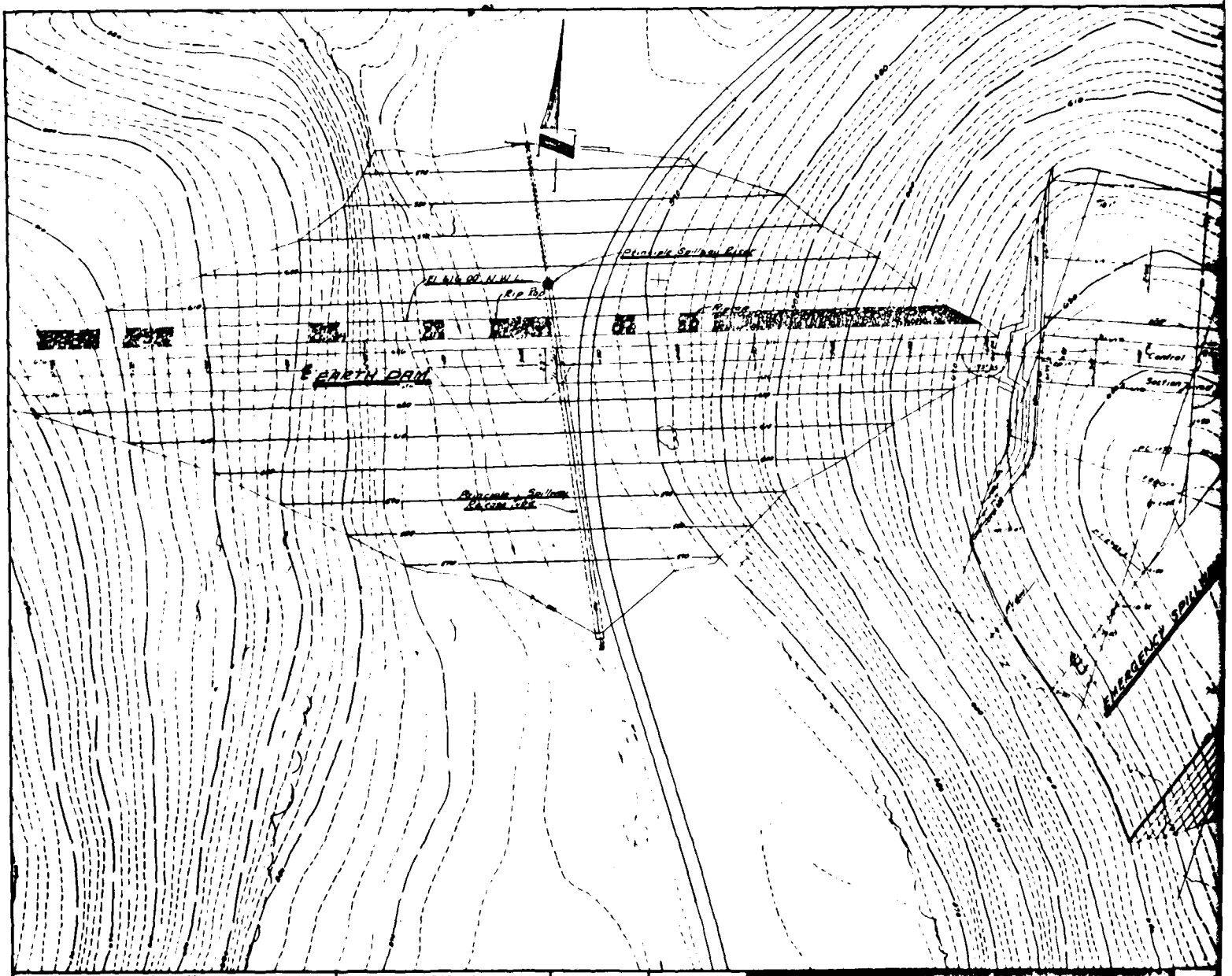
BORING LOG

FREDERICK COUNTY, VIRGINIA

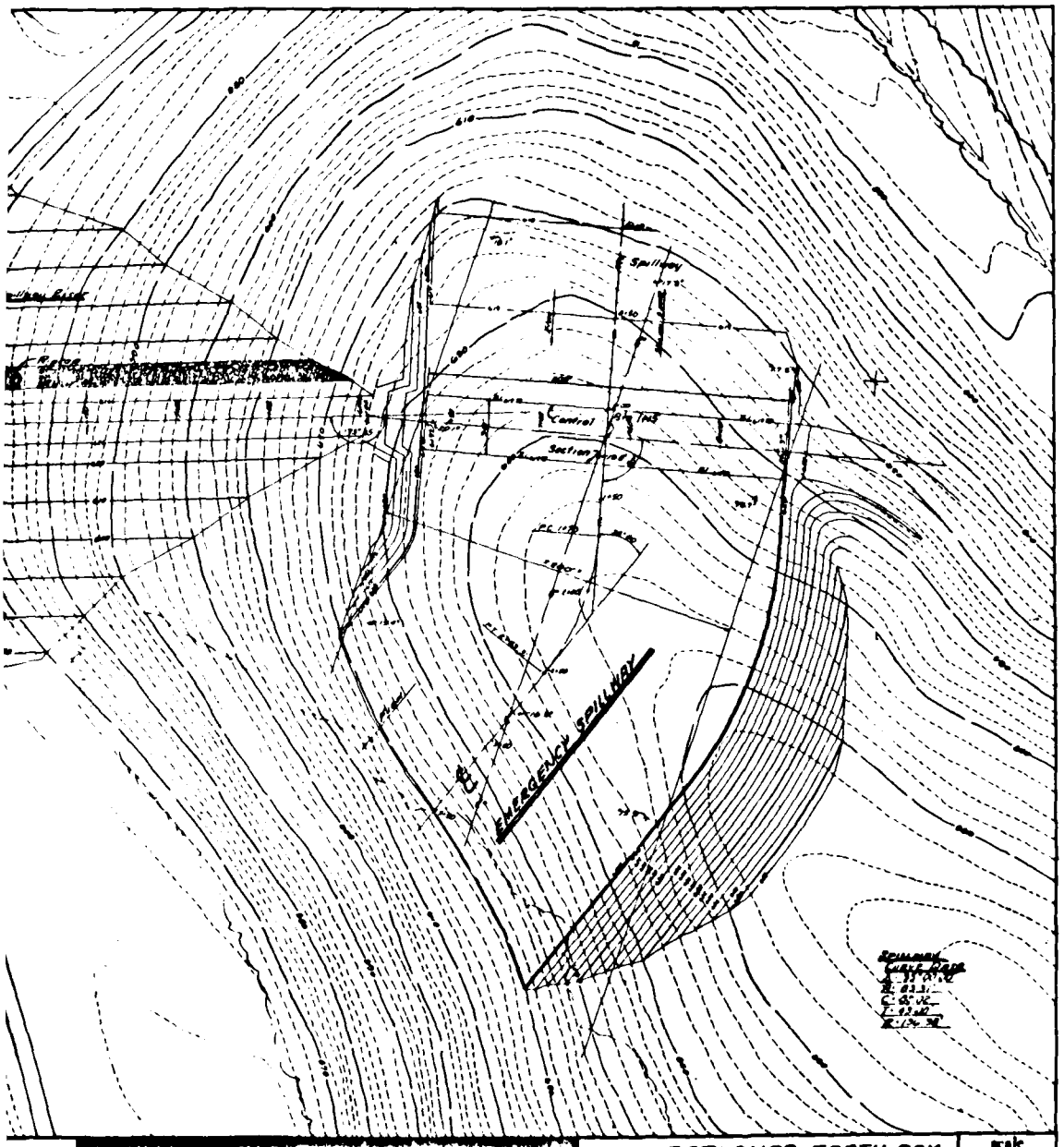
scale 1"=10'

sheet 3 of 9

1 2



				job number	7483-3
				date	MAY 6, 1975
				designed by	
				drawn by	BNS
				approved by	

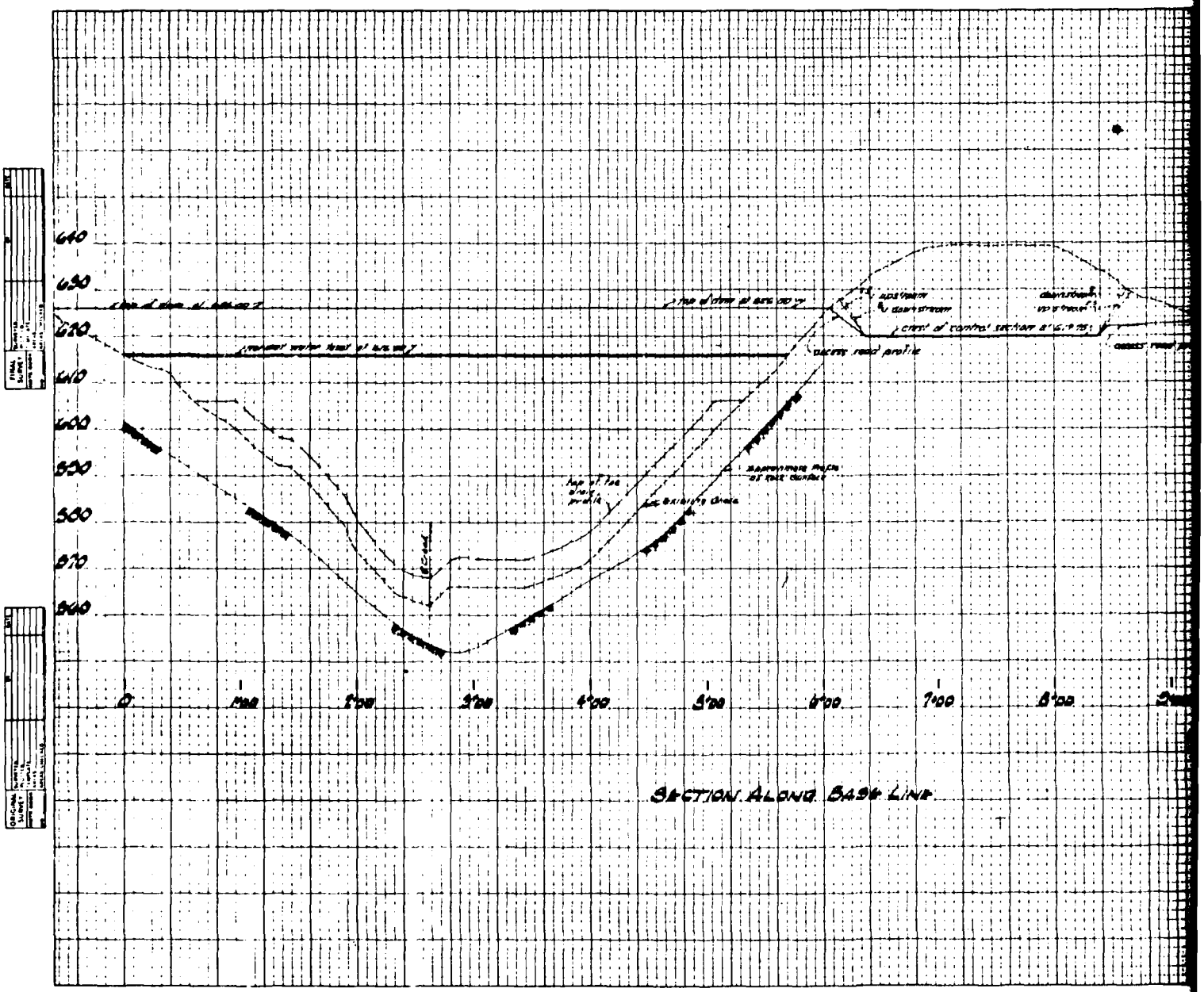


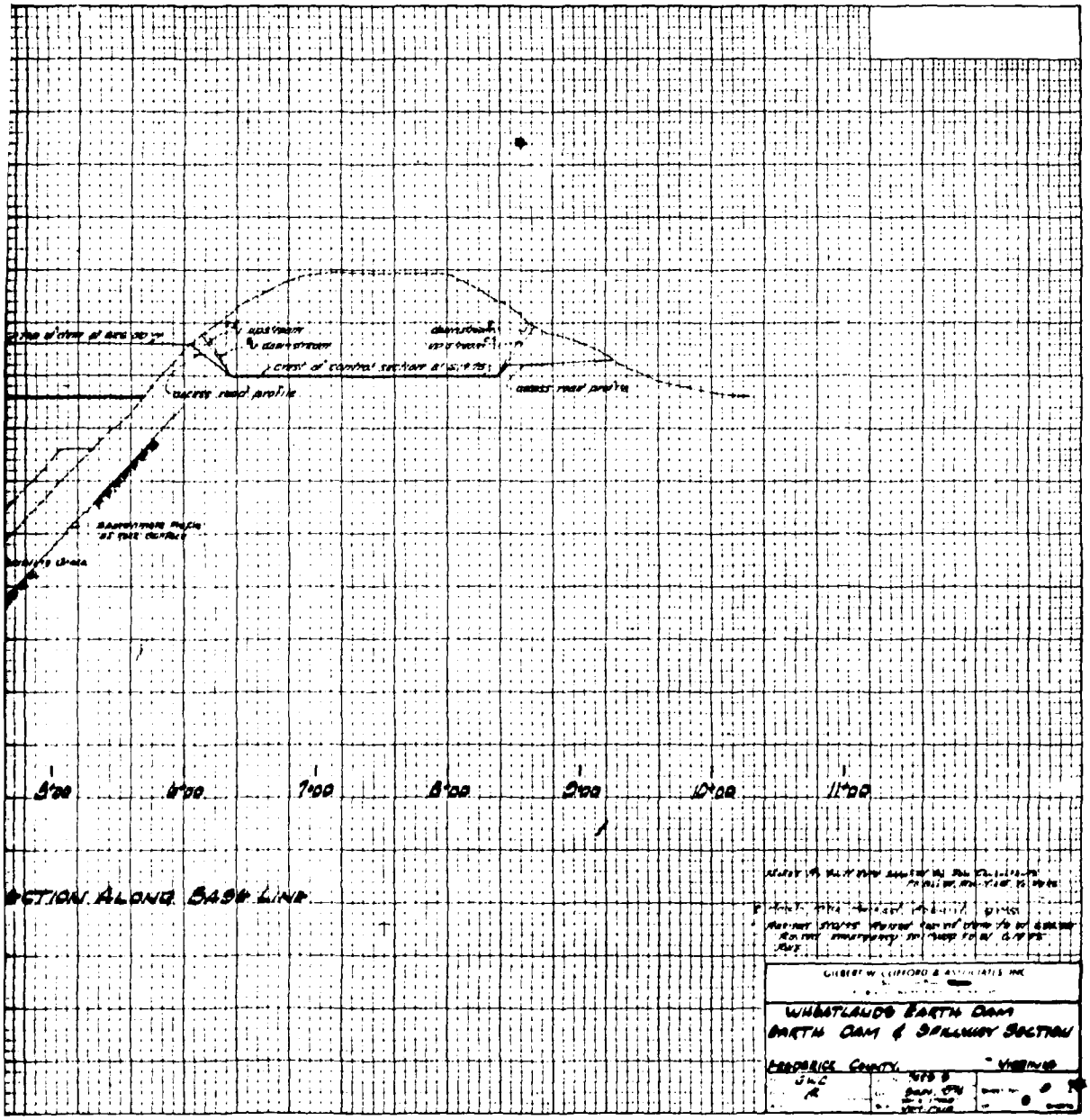
WHEATLANDS EARTH DAM
FREDERICK COUNTY, VIRGINIA

PLAN OF
EARTH DAM & EMERGENCY SPILLWAY

scale 1"=80'

sheet 1 of 2


640
630
620
610
600
590
580
570
560
0
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
Top of dam at elev. 630.0'
Normal water level at elev. 610'
Crest of control section at elev. 615.75'
Access road profile
Top of toe drain profile
Approximate limits of rock excavation
Exc. excavated channel
SECTION ALONG BASE LINE

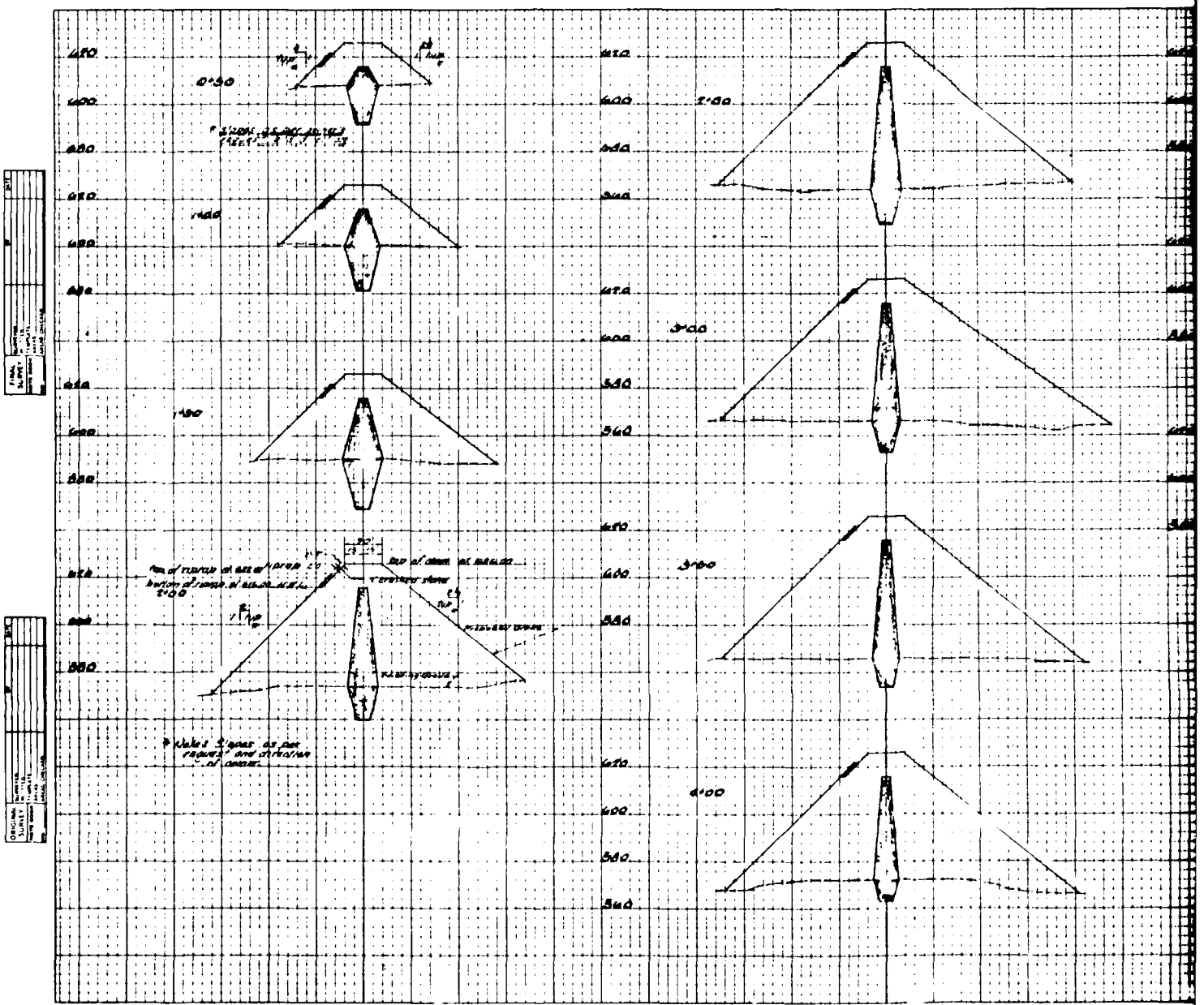


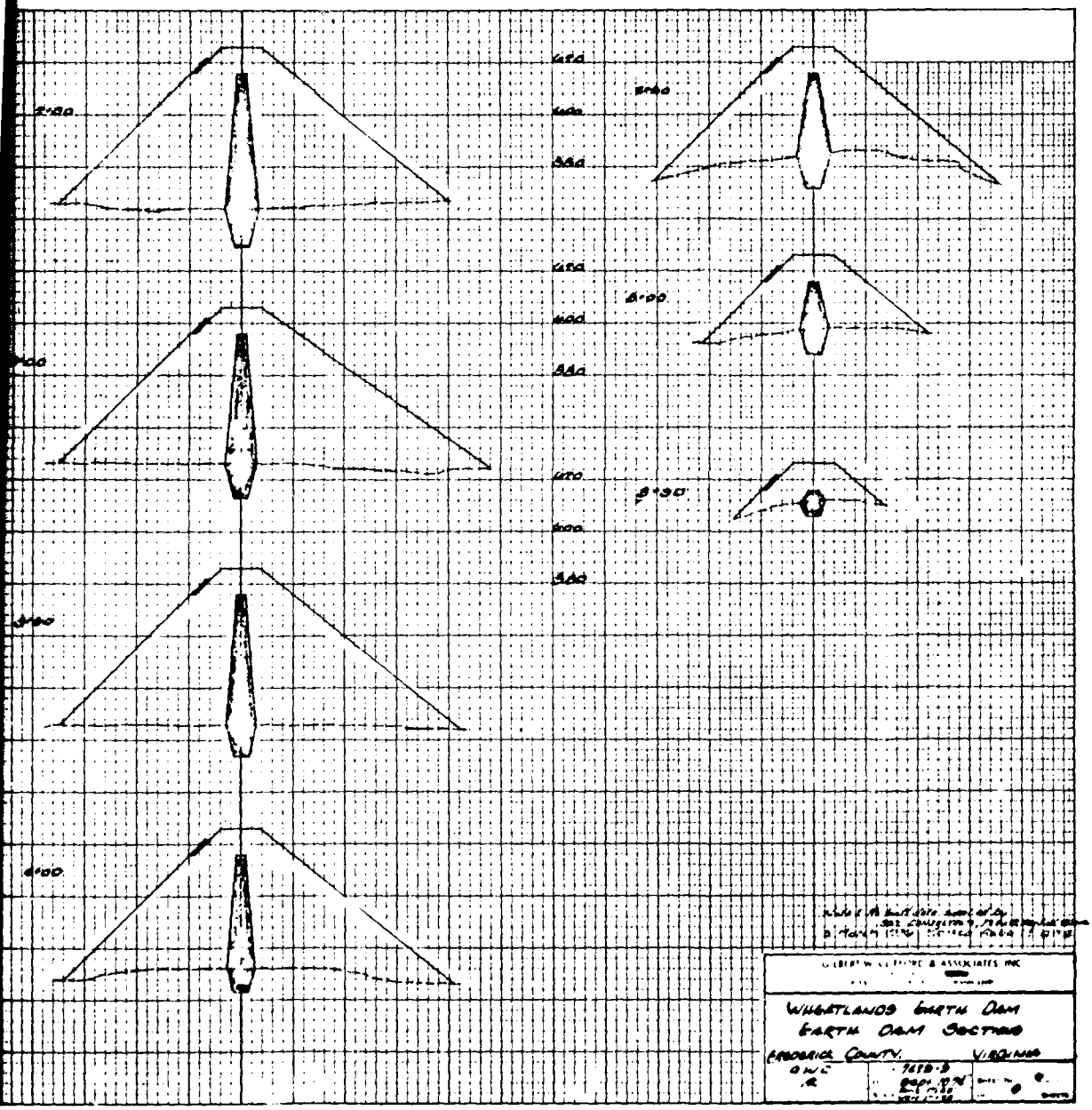
SECTION ALONG BASE LINE

WHEATLANDS EARTH DAM

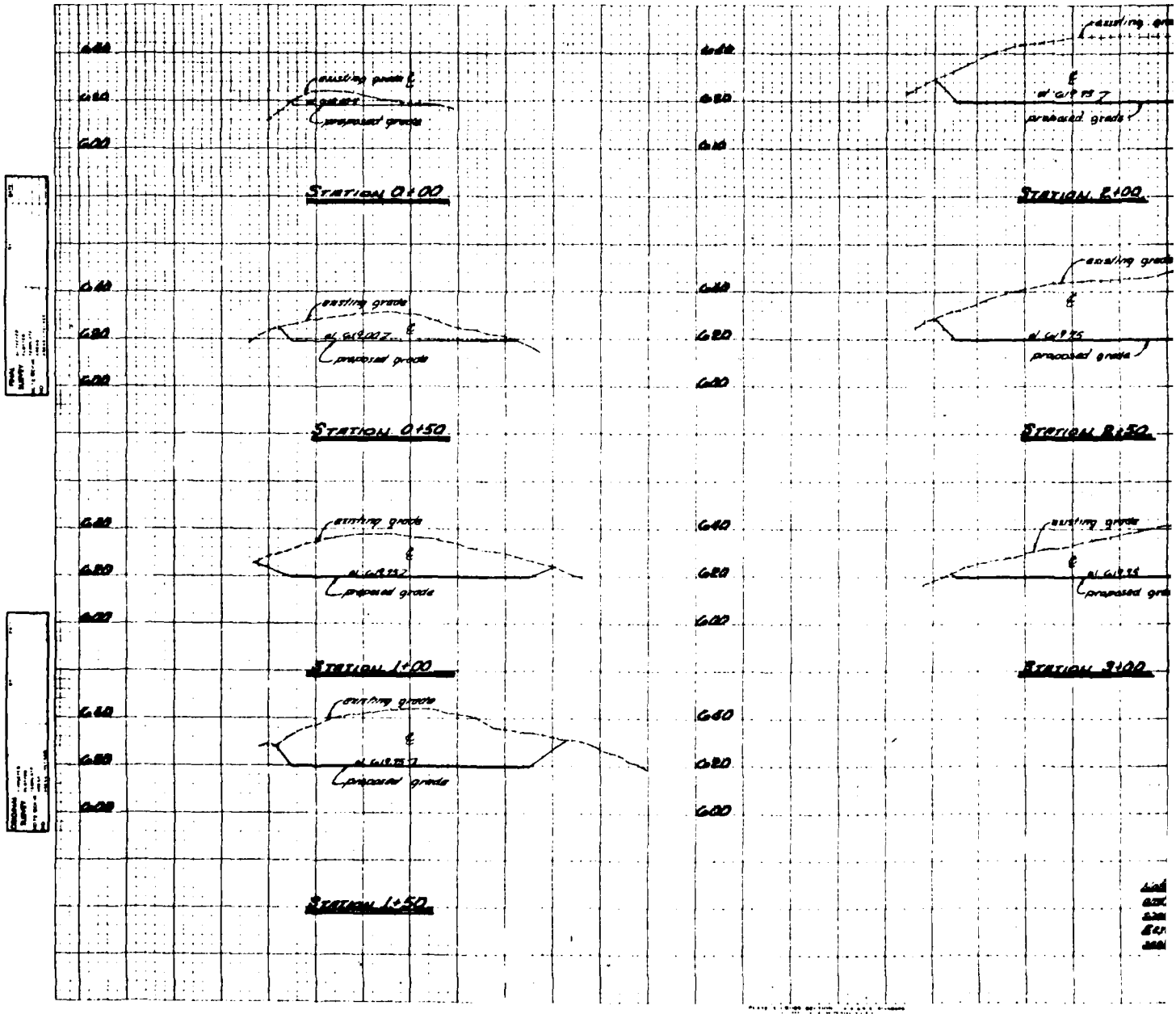
EARTH DAM & SPILLWAY SECTION

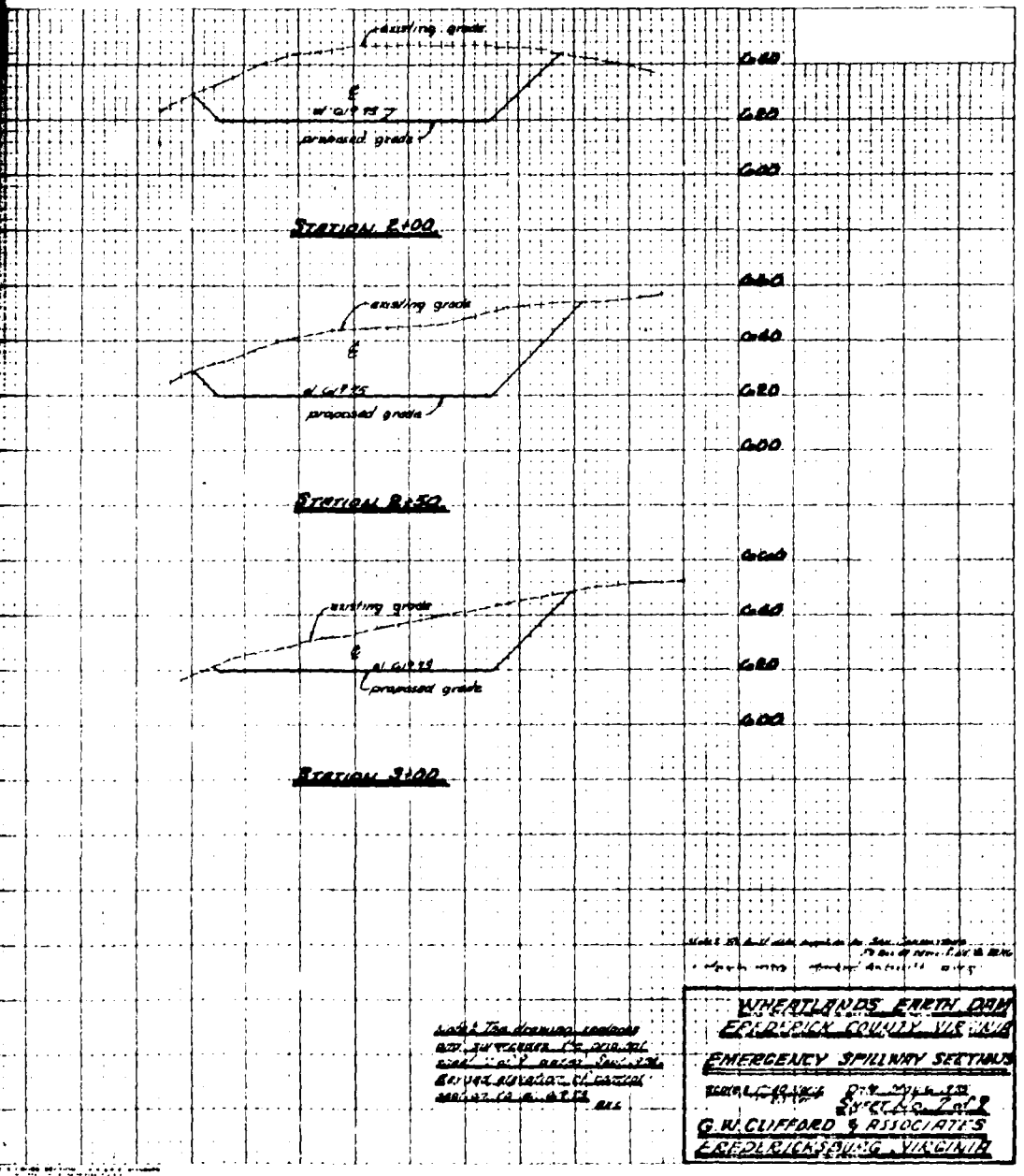
FREDERICK COUNTY, MARYLAND


0·50
1·00
1·50
2·00
3·00
3·00
4·00

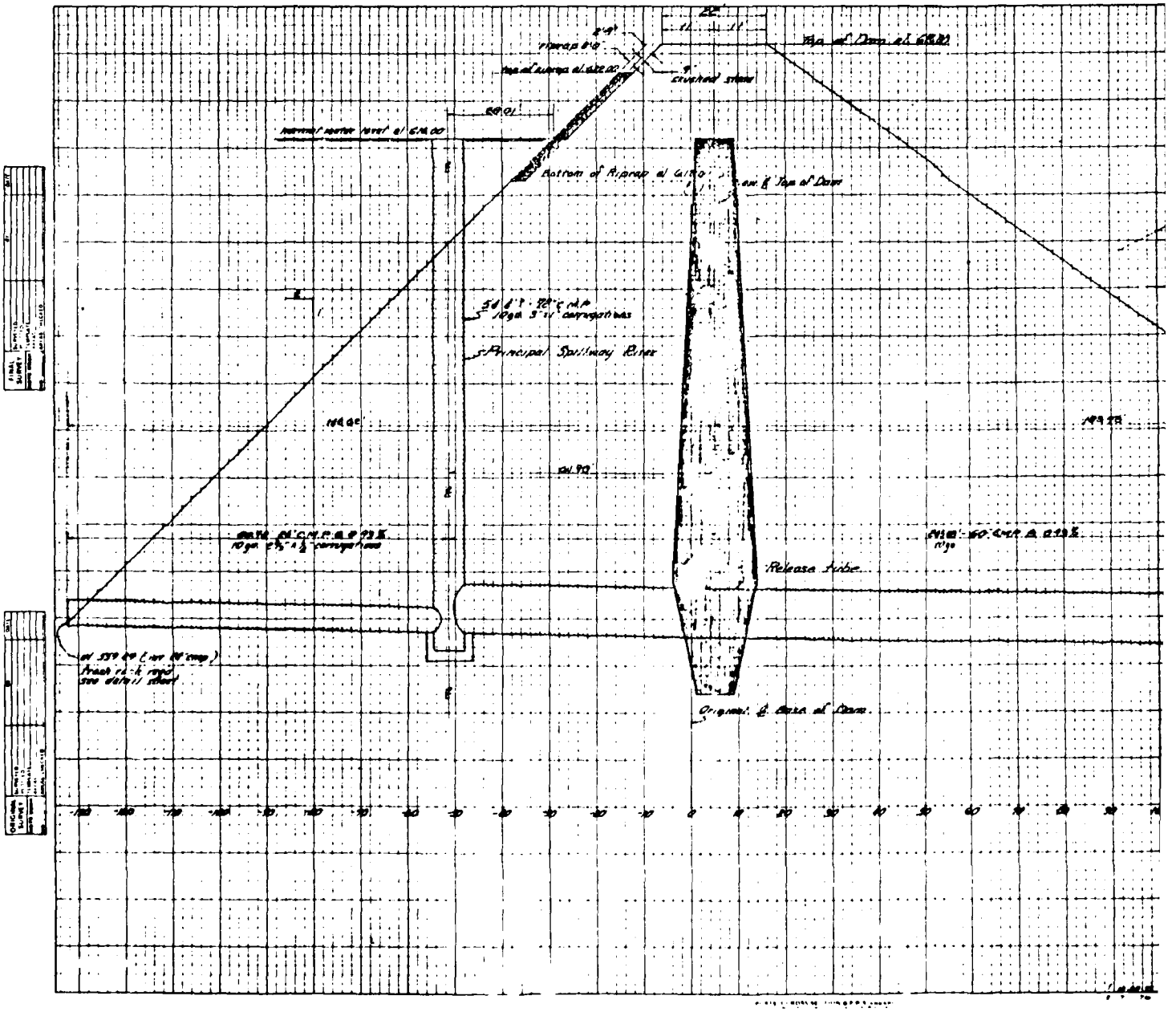


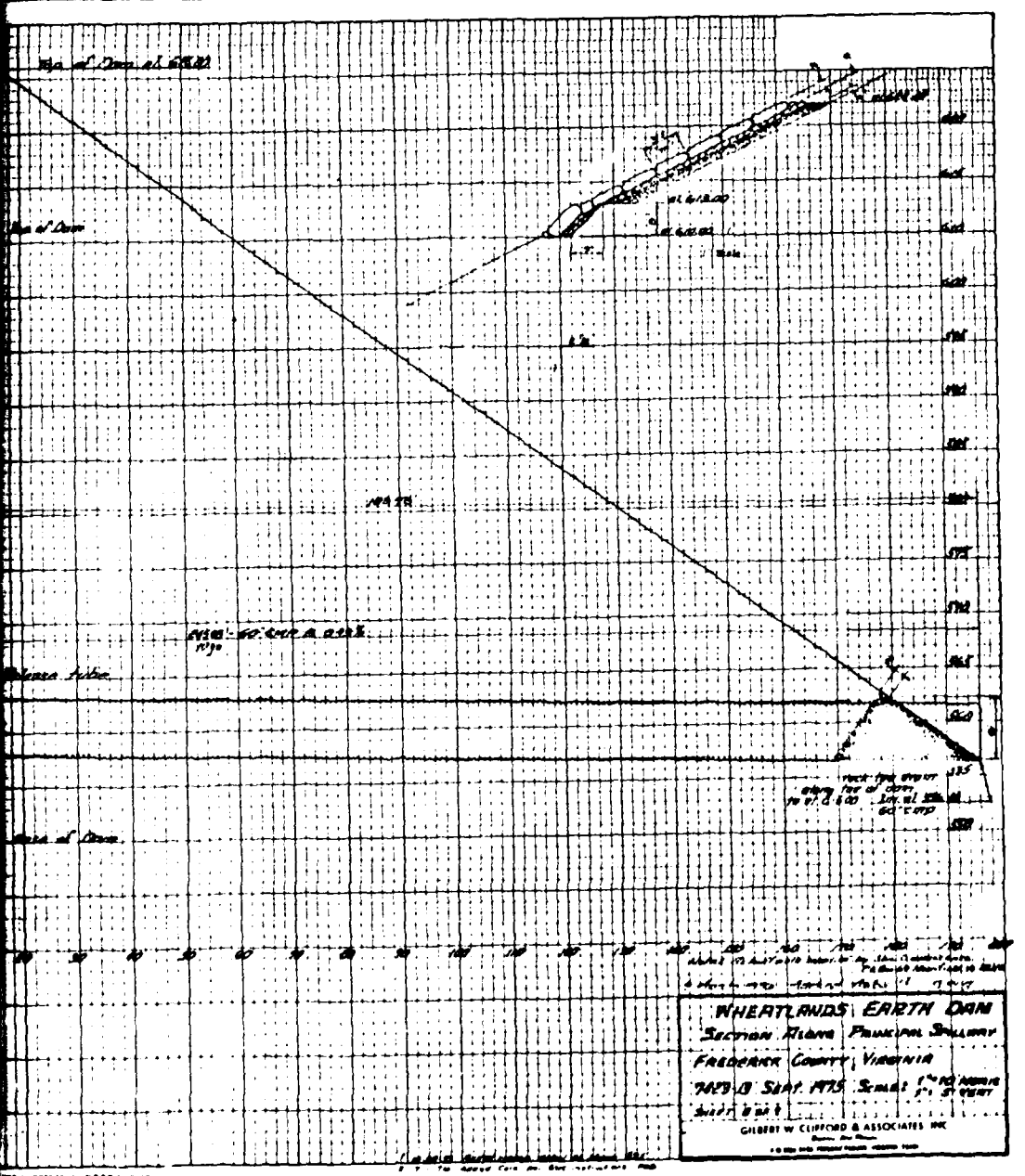
WHEATLANDS EARTH DAM
EARTH DAM SECTIONS
FREDERICK COUNTY, VIRGINIA

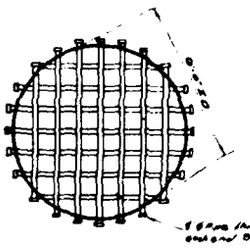

STATION 0+00
existing grade
proposed grade
STATION 0+50
existing grade
proposed grade
STATION 1+00
existing grade
proposed grade
STATION 1+50
STATION 2+00
existing grade
proposed grade
STATION 2+50
existing grade
proposed grade
STATION 3+00



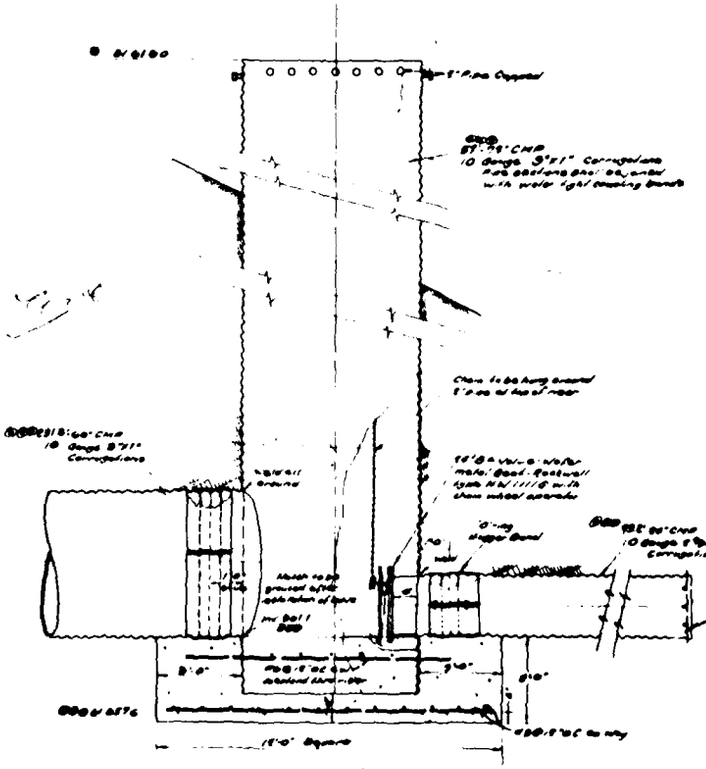
WHEATLANDS EARTH DAM
FREDERICK COUNTY, VIRGINIA
EMERGENCY SPILLWAY SECTIONS
G. W. CLIFFORD & ASSOCIATES
FREDERICKSBURG, VIRGINIA


Riprap 6'-0"
Top of Riprap at 652.00
Top of Dam at 652.00
Normal water level at 614.00
Bottom of Riprap at 610.0
Top of Dam
Principal Spillway Pipes
Release Tube
Original ℄ Crest of Dam


WHEATLANDS EARTH DAM
SECTION ALONG PRINCIPAL SPILLWAY
FREDERICK COUNTY, VIRGINIA
GILBERT W. CLIFFORD & ASSOCIATES INC



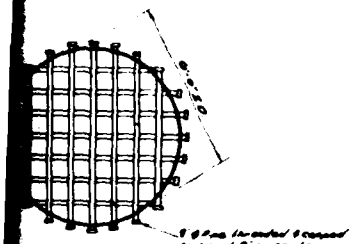
TRASH RACK



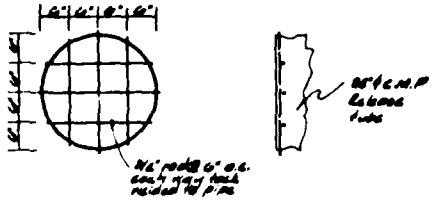
SPILLWAY RISER

DEVISIONS					
no.	date	description	by	app'd
1	10/7/76	Revised Sections, Details & Notes	RJF	
2	10/7/76	Revised Trash Rack Details	RJF	
3	12/9/76	Revised to reflect 1 Pipe Riser	RJF	

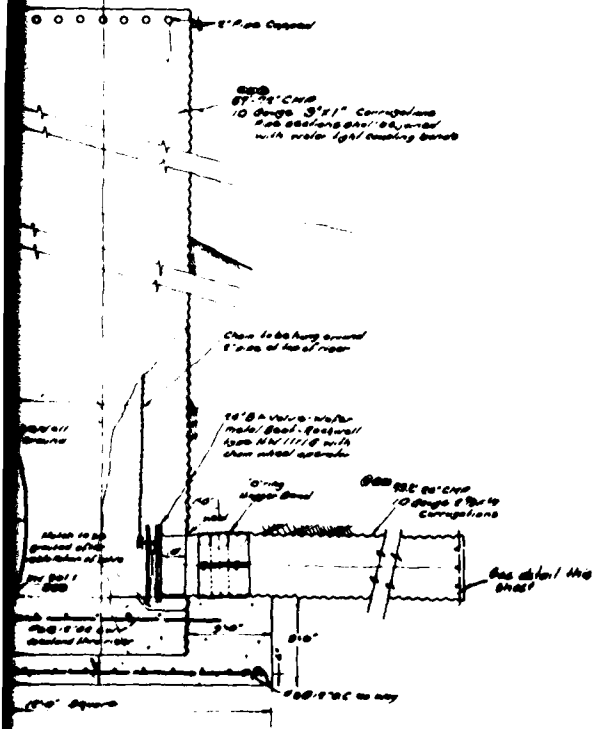
job number 7628-3
date 8 Oct 1976
designed by G.W.C.
drawn by R
approved by



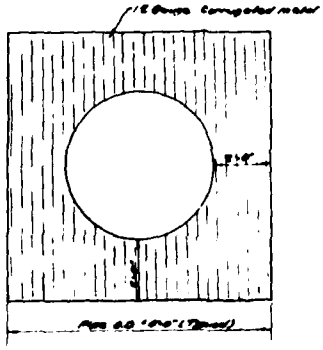
TRASH RACK



TRASH RACK DETAIL



SPILLWAY RISER



ANTI-SEEP COLLAR

WILDCATLANDS EARTH DAM	scale AS SHOWN
FREDERICK COUNTY, VIRGINIA	sheet 9 of 10
PRINCIPAL SPILLWAY DETAILS	

APPENDIX II

PHOTOGRAPHS

PHOTO #1 CREST

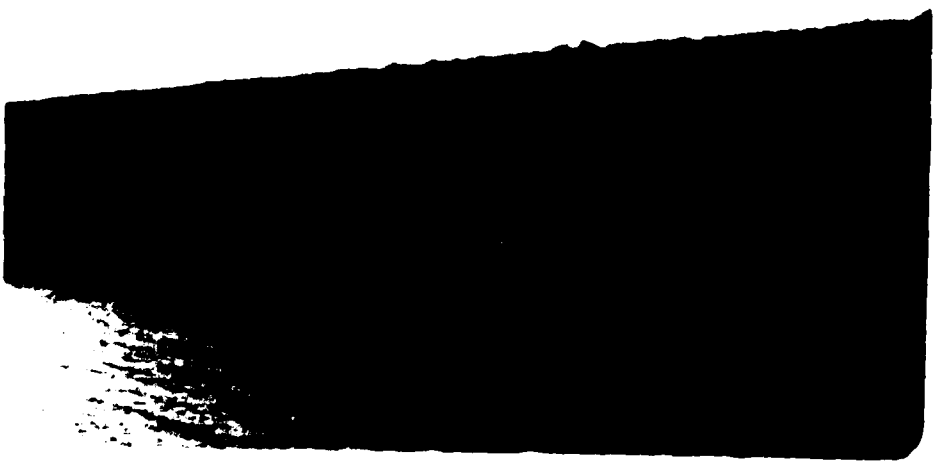


PHOTO #2 UPSTREAM FACE

PHOTO #3 DOWNSTREAM FACE

PHOTO #4 MARSHY/BOGGY WET
AREA BEYOND TOE OF DAM

PHOTO #5 ERODED AREA ON U/S SLOPE AROUND (DAMAGED) PRINCIPAL SPILLWAY INTAKE

PHOTO #6 72-INCH DIA. PRINCIPAL SPILLWAY (DAMAGED) INTAKE

PHOTO #7 60-INCH DIA. PRINCIPAL SPILLWAY OUTLET

PHOTO #8 PLUNGE POOL & DOWNSTREAM AREA

PHOTO #9 EMERGENCY SPILLWAY

PHOTO #10 EMERGENCY SPILLWAY

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Dam: Wheatlands | County: Frederick | State: Virginia | Coordinates: Lat. 3902.5 Long. 7809.8

Date of Inspection: 29 Oct 80 | Weather: Fair and Cool | Temperature: 45°-55° F

Pool Elevation at Time of Inspection: 580+ ft msl | Tailwater at Time of Inspection: 559 ± ft msl

Inspection Personnel:

D. Pezza, COE	L. Jones, COE	J. L. Bowman, Owner
J. Robinson, COE	D. Bushman, SWCB	F. L. Glaize, Owner
B. Taran, COE	H. Gildea, SWCB	H. Van Aller, Law Engr

Pezza & Robinson Recorders

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	No surface cracks were observed. A road was cut from the left abutment to the riser on the upstream slope about two-thirds down from the crest. An erosion gully exists on the downstream right abutment contact overgrown with grass. The ground conditions were dry.	None
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No unusual movement or cracking was observed.	None
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	The right upstream and downstream abutments have a dirt road that traverses the contact. The riser pipe collapsed during a Spring '78 ice thaw. The corrugated metal pipe unraveled creating an eddy current. The current eroded a large portion of the area embankment. Presently, there is a scarp about 20 ft. in height with a near vertical face. The left downstream abutment is buttressed with fill and is well vegetated with grass. There is erosion due to eddy currents and animal burrows around the discharge pipe.	Establish light vegetation of the scarp to protect the exposed slope. Riprap around the discharge pipe to prevent further erosion. Backfill and seed animal holes.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The vertical and horizontal alignments do not deviate from the available drawings. The crest serves as a dirt road. There are a few riprap boulders strewn on the crest along the upstream slope.	None

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RIPRAP FAILURES	A portion of the upstream slope is protected with limestone dolomite riprap. The riprap is bedded and has armor stone up to 3 feet in size.	None.
FOUNDATION	The drawings show that the core was keyed into rock. Logs indicate that the foundation rock is shale. Rock cutcrops in the emergency spillway and on the downstream right abutment consist of thinly bedded oxidized shale. The abutment outcrop strikes N30°W with a near vertical dip. The spillway outcrops also strikes N30°W with a vertical dip. The strikes are near pendicular to the axis of the dam. The dam axis is N85°E.	None.
ANY NOTICEABLE SEEPAGE	There are two wet spots as identified and described on Plate I at back of checklist.	None.
DRAINS	The drawings show a toe drain. However, the owners say no drain was constructed.	None.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MATERIALS	The embankment material is a high plastic clay (CH) mixed with shale rock fragments up to 12 inches in size. The drawings show a core. The owners report that a core was constructed of clay.	None.
VEGETATION	The upstream slope is lightly vegetated with field grass and brush. Also there are several Sycamore saplings on the dam. The downstream slope is well vegetated with field grass. The crest is bare.	Cut all brush and trees to the ground.

EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTIONS	The control section is in natural ground with a few rock outcrops. The control section is 200 feet wide with an access road passing through it. A portion of the damaged 72" CMP presently sits in the control section	The 72-inch CMP should be removed.
APPROACH CHANNEL	The approach channel is grassed and in good condition.	None
DISCHARGE CHANNEL	The discharge channel is steep and heavily wooded.	Trees should be thinned to reduce the potential for debris to collect and dam flows through the spillway.
BRIDGE AND PIERS	N/A	
MISCELLANEOUS	N/A	

PRINCIPAL SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTIONS	The 72-inch CMP collapsed in March 1978. The damaged was caused by an ice thaw. The crest was lowered to approximately 585 from 616. The CM sheeting unraveled into the outlet pipe. A tree limb is resting on the existing invert.	The unraveled CM sheeting and tree limb should be removed from the outlet. The intake should be protected from debris and further damage.
APPROACH CHANNEL	The intake pipe is lower than the surrounding embankment. This condition may permit further erosion around the intake.	The embankment should be protected from further washing into the intake.
DISCHARGE CHANNEL	The 72-inch CMP was observed to be leaking at two levels below the crest. The unraveled CMP is wedged into the outlet pipe. The stilling basin is deep with no riprap. The outlet pipe is partially submerged.	It is possible the outlet pipe may have been damaged as well.
BRIDGE AND PIERS	N/A	
EMERGENCY GATE	The 24-inch CMP intake pipe is controlled by a butterfly valve at the bottom of the 72-inch drop-inlet principal spillway. The control stem is broken and inoperable. The valve is closed but the seal is leaking.	The control stem should be repaired.
GATES AND OPERATION EQUIPMENT	N/A	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION
MONUMENTATION/SURVEYS	There are no monuments.	None
OBSERVATION WELLS	Law Engineering installed 3 wells in 1976 as a post-construction measure to monitor reported seepage.	None
WEIRS	There are no weirs.	None
PIEZOMETERS	There are no piezometers.	None
STAFFGAGES	There are no staffgages.	A staffgage should be placed in the reservoir area to visually monitor pool elevations.
OTHER	There are no other types of instrumentation.	None.

RESERVOIR

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The reservoir slopes are mild and clear at least up to original waterline. The area above the original normal pool is heavily wooded and steeper. There are no signs of slope failure. There is no shoreline debris.	None
SEDIMENTATION	The inspection team was unable to determine if there is a sedimentation problem. No sedimentation was observed or reported.	None

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is narrow and shallow with a wide flat flood plain. The area is actively used by wildlife. There is little tree growth that would obstruct flows from the dam.	None.
SLOPES	The flood plain is flat and wide as the dam. The side slopes are steep and wooded.	None
APPROXIMATE NO. OF HOMES AND POPULATION	Several homes are located in Nineveh, Virginia about 1-1/2 miles downstream. These homes may receive flood damage if the Wheatlands Dam fails.	None

APPENDIX IV

CONSTRUCTION RECORDS

CONSULTANTS, INC. 2340 JERMYN STREET, P.O. BOX 60, MERRIFIELD, VIRGINIA 22116
TEL: (703) 560-3110

October 10, 1975

Mr. Tom O'Toole
Gilbert Clifford & Associates
P. O. Box 5425
Fredericksburg, Virginia 22401

RE: Wheatlands Dam
Job No. 4884

Dear Tom:

The toe drain as shown was not installed, however it should be put in.

The cut off core starts at Elevation 5400 ± width 15.0' ± at Elevation 565.0 ±. Core is 25' wide ± tapers to width of 10.0' ± at Elevation 616.0 ±. The core was built on the old centerline.

Dick has furnished the following notes:

SHEET 3 of 9

1) A rock toe drain could be and should be installed.

2) Back of dam should be seeded promptly.

3) Trash rack was not installed in front of 24" cmp. Needs to be.

4) Trash rack on Riser was not correct - needs to be redone.

5) Out flow channel should have rock or small riprap along sides to maintain channel from siltation. Also-channel needs to be dredged out after recent rains.

6) No inspection was made of the rip-rap at front of dam.

SHEET 4 of 9

Berm built of spillway soil and rock - if you want to show.

This was put in to guard back of dam toe from possible wash out and as a place to put spillway cut materials.

This was not inspected so would have to be located if desired to be placed on final drawing.

Road entrance from east-across spillway and across dam top not shown. Perhaps not wanted on this drawing.

Otherwise - Sheet 4 seems O.K.

Very truly yours,

Glenn V. Wilson
Executive Vice President

GVW:gmb

CONSULTANTS, INC. 3800 JUNIPER STREET, P.O. BOX 40, MERRIFIELD, VIRGINIA 22116
TEL: (703) 560-3110

March 4, 1976

Tom O'Toole
Clifford & Assoc. Inc.
P.O. Box 5425
Fredericksburg, Va. 22401

Dear Tom,

In reviewing the plans on Wheatland Dam, I note a few changes that should be put on the final plans.

1. The cutoff core extends to the water line. Actually it is a zoned fill to the waterline, with a center silty clay core, with silty clay & shale on the upstream side and more shaly material on the downstream side.

2. The toe drain was not installed. I think it should have been, but if there is any seepage, it can easily be installed. You should advise Glaize & Bowman, that if they observe any seepage a toe drain should be installed.

3. There is a berm between the downstream side of the emergency spillway and the dam. This will have to be located in the field.

As I told you by phone the dam looks good and is about one fourth full. The valve is not completely closed.!! - with the exception of the three items it was constructed according to your plans.

Yours very truly,

Glenn V. Wilson
Executive Vice President

GVW/jw

gilbert w. clifford & associates, inc.

INCORPORATED 1972

ROUTE 17 AT BEREA • P O BOX 5425 • FREDERICKSBURG VIRGINIA 22401 • 703/752-5011

BOARD OF DIRECTORS GILBERT W CLIFFORD P E THOMAS J O TOOLE P E EARL R SUTHERLAND P E

August 14, 1975

Mr. James Bowman & Mr. Fred Glaize

RE: Frederick County
Wheatland Earth Dam

Dear Sir:

Subsequent to our discussion and my visit to the site on Wednesday August 6, 1975 and my return visit on Monday August 11, 1975, it is apparent that several matters require clarification.

1. Normal Water Level: As we all know the original design called for normal water level to be 606.00. At your request, the possibility of raising to the 616.00 elevation was investigated. It was stated at that time that the northern finger of the reservoir possibly would be off your property. From my field reconnaissance on Monday it is evident that it definitely will be.

Another matter of consideration in raising the water level is the effect on the springs feeding the reservoir. At 606.00 it is questionable as to the adequacy of the springs. To add on additional ten feet may result in further compounding the problem. Naturally, we all recognize the unpredictability of springs and hopefully this will not present problems in the future, but it definitely is of concern to us.

2. Roadway over dam: As you will recall the Virginia Department of Highways will not accept a road over a spillway and dam into their system. Therefore, the type of road originally designed over the dam was to a private road with dual lanes 22' in width and 8' shoulders. In the vicinity of the spillway it must be borne in mind that the road will be subject to flooding.

Therefore, assuming the normal water level is to be 616.00 and the top of dam at 626; for the roadway over the dam to be forty foot wide, the 24 inch pipe will have to be lengthened by 8 1/2 feet and the 60" 14 feet. This will permit a 2.1 slope on the upstream side and a 2 1/2 to 1 on the downstream. This is the recommended design.

Engineers

[illegible] • [illegible] • 703 [illegible]

If after you have had time to review this please contact us as to what course of accion you wish to pursue.

Very truly yours,

GILBERT W. CLIFFORD & ASSOCIATES, INC.

Thomas J. O'Toole

Thomas J. O'Toole, P.E.
Vice-President

ma

SOIL CONSULTANTS, INC.

MERRIFIELD, VIRGINIA 22116

Job No. 4884

Date 3/4/75

RESULTS OF IN-PLACE DENSITY TESTS

Project:

WHEATLANDS DAM

Location:

FREDRICK COUNTY, VIRGINIA

Tested For:

FRED L. GLAIZE, III AND JAMES L. BOWMAN

Method

TEST NO.	LOCATION	ELEVATION	WET DENSITY PCF	PERCENT MOISTURE	DRY DENSITY PCF	MAXIMUM LAB DRY DENSITY PCF	OPTIMUM MOISTURE PERCENT	PERCENT COMPAC-TION
7/30/75								
D-21	CORE	575±	114.80	20.4	95.35	94.1	25.0	101.3
D-22	CORE	575±	115.20	20.7	95.40	94.1	25.0	101.4
D-23	FRONT	575±	117.30	18.6	98.85	106.4	18.0	93.0
D-24	FRONT	575±	119.10	17.6	101.30	106.4	18.0	95.2
D-25	BACK	575±	130.40	12.8	115.60	117.4	12.8	98.5
D-26	BACK	575±	130.90	12.3	116.55	117.4	12.8	99.3
D-27	CORE	582±	114.45	19.5	95.80	94.1	25.0	101.8
D-28	CORE	582±	115.00	19.7	96.10	94.1	25.0	102.0
D-29	FRONT	582±	120.50	16.2	103.70	106.4	18.0	97.5
D-30	FRONT	582±	120.80	15.7	104.40	106.4	18.0	98.0
D-31	BACK	582±	129.50	12.2	115.40	117.4	12.8	98.3
D-32	BACK	582±	129.00	11.7	115.50	117.4	12.8	98.4

CONSULTANTS, INC. 2800 JUNIPER STREET, P.O. BOX 69, MERRIFIELD, VIRGINIA 22116
TEL. (703) 560-3110

FIELD DENSITY TEST REPORT

CLIENT: Fred Glaize, and James Bowman
REPORT DATE: September 16, 1975

PROJECT: Wheatlands Dam Site
TEST DATE: 8/29 & 9/2 & 9/8/75

LOCATION: Fredrick Co., Virginia
WEATHER:

PROJECT NO: SCI Job No. 4884

No.	FIELD DATA		LAB DATA			
	Field Density	Field (%) Moisture	Optimum (%) Moisture	Maximum Density	Percent Compaction	Locations
D-41	118.30	11.0	12.8	117.4	100.7	Front, 605
D-42	115.20	13.0	18.0	106.4	108.2	Core, 605
D-43	117.95	10.7	12.8	117.4	100.4	Back, 605
D-44	117.65	11.6	12.8	117.4	100.2	Front, 6.0
D-45	117.80	11.8	12.8	117.4	100.3	Front, 610
D-46	110.15	15.3	18.0	106.4	103.5	Core, 610
D-47	110.45	15.6	18.0	106.4	103.8	Core, 6.0
D-48	115.30	11.0	12.8	117.4	98.2	Back, 610
D-49	115.10	10.7	12.8	117.4	98.0	Back, 610
D-50	115.70	11.0	12.8	117.4	98.5	Front, 616

Above tests results represent spot checks only.
Note: Densities reported in pounds per cubic foot, dry.

Maximum density in accordance with: ASTM-D-698-70 C

Testing Technician:

Distribution:

Richard C. Anderson
Director Technical Service

3-1

LIKE PEOPLE-SOILS ARE DIFFERENT

CONSULTANTS, INC. 2300 JUNIPER STREET, P.O. BOX 69, MERRIFIELD, VIRGINIA 22116
TEL: (703) 560-3110

FIELD DENSITY TEST REPORT

CLIENT: Fred Glaize, and James Bowman

REPORT DATE: September 16, 197

PROJECT: Wheatlands Dam Site

TEST DATE: 8/29 & 9/2 & 9/8/75

LOCATION: Fredrick Co., Virginia

WEATHER:

PROJECT NO: SCI Job No. 4884

	FIELD DATA		LAB DATA			
No.	Field Density	Field (%) Moisture	Optimum (%) Moisture	Maximum Density	Percent Compaction	Locations
D-51	115.75	10.9	12.8	117.4	98.6	Front, 616
D-52	116.20	10.5	12.8	117.4	98.9	Front, 616
D-53	106.10	14.3	18.0	106.4	99.7	Core, 616
D-54	107.05	14.3	18.0	106.4	100.6	Core, 616
D-55	114.70	10.0	12.8	117.4	97.7	Back, 616
D-56	115.20	10.0	12.8	117.4	98.0	Back, 616
D-57	114.65	9.8	12.8	117.4	97.6	Back, 616
D-58	105.65	13.5	18.0	106.4	99.3	Core, 616

Above tests results represent spot checks only.
Note: Densities reported in pounds per cubic foot, dry.

Maximum density in accordance with: ASTM-D-698-70 C

Testing Technician:

Distribution:

Richard C. Anderson
Director, Technical Services

To:

LIKE PEOPLE-SOILS ARE DIFFERENT

SOIL CONSULTANTS, INC.

MANASSAS, VIRGINIA 22110

Job No. 4834

Date July 8, 19

RESULTS OF IN-PLACE DENSITY TESTS

Project: Wheatlands Dam Site

Location: Fredrick Co., Virginia

Tested for: Glaize Development, Co.

ASTM-D-698-70 C Method

TEST NO.	LOCATION	ELEVATION	WET DENSITY PCF	PERCENT MOISTURE	DRY DENSITY PCF	MAXIMUM LAB DRY DENSITY PCF	OPTIMUM MOISTURE PERCENT	PERCENT COMPACTION
D-6	3 + 00	559'	111.30	13.5	98.10	94.1	25.0	104.3
D-7	2 + 75	559'	109.90	14.7	87.05	94.1	25.0	93.5
D-8	2 + 50	559'	108.60	15.8	85.10	94.1	25.0	90.4
D-9	Retest D-7	559'	112.30	13.4	99.00	94.1	25.0	105.0
D-10	Retest D-8	559'	112.00	13.7	98.50	94.1	25.0	104.6

Core?

Richard C. Anderson
Director: Technical Services

SOIL

CONSULTANTS, INC. 2300 JUNIPER STREET, FAIRFIELD, VIRGINIA 22116
TEL. (703) 560-3110

SAMPLE No. B

Job Name and Location _____

Architect or Engineer _____

Contractor _____

A. Description of Soil: _____

Material Mark _____ United Classification _____ AASHO Classification _____

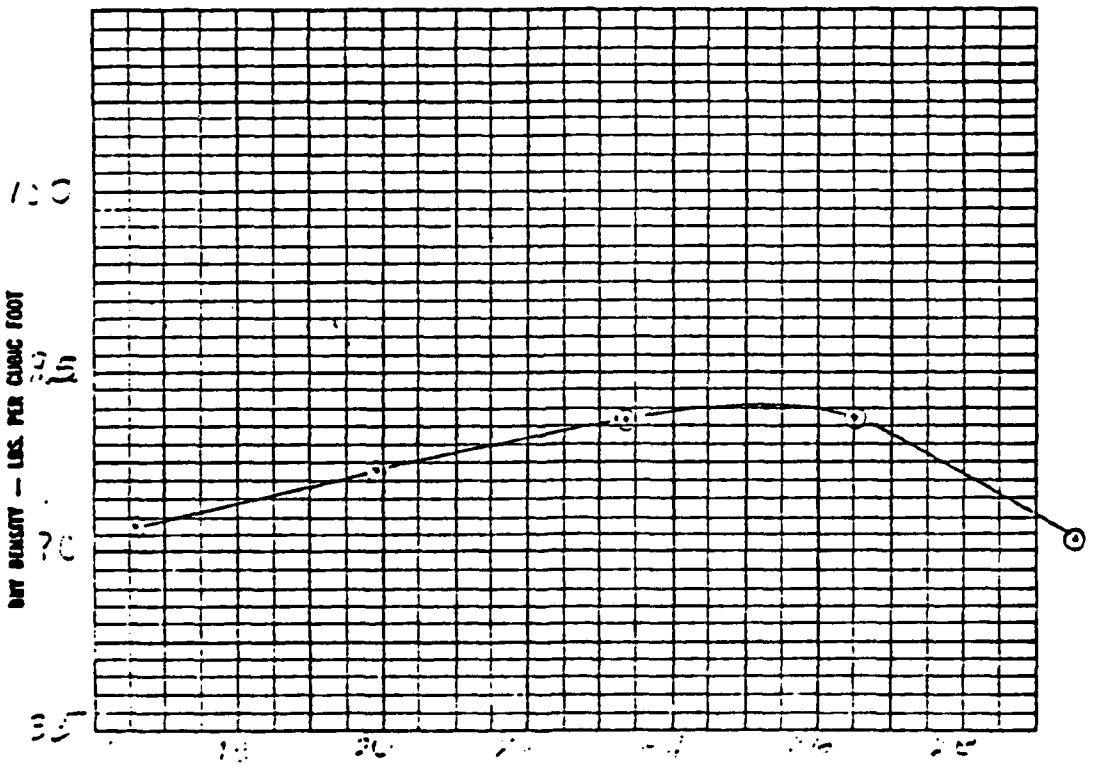
Source of Material _____

Natural Water Content _____ % Natural Dry Density _____ PCF Specific Gravity _____

Liquid Limit _____ % Plastic Limit _____ % Plasticity Index _____

B. Test Procedure Used: _____

C. Test Results: Maximum Dry Density 94.1 PCF Optimum Water Content 25.0 %



SOIL CONSULTANTS, INC.

MERRIFIELD, VIRGINIA 22116

Job No. 4884

Date July 14, 19

RESULTS OF IN-PLACE DENSITY TESTS

Project Wheatlands Dam

Location Fredrick Co., Virginia

Tested for Glaize Development, Inc.

ASTM-D-698-70 C Method

TEST NO.	LOCATION	ELEVATION	WET DENSITY PCF	PERCENT MOISTURE	DRY DENSITY PCF	MAXIMUM LAB DRY DENSITY PCF	OPTIMUM MOISTURE PERCENT	PERCENT COMPACTION
7/7/75								
D-11	2 + 50	564 ±	114.65	15.4	99.40	94.1	25.0	105.8
D-12	3 + 00	564 ±	113.80	16.0	98.05	94.1	25.0	104.0
D-13	3 + 50	564 ±	113.70	16.4	97.70	94.1	25.0	103.8
D-14	2 + 50	568 ±	113.65	15.9	98.00	94.1	25.0	104.0
D-15	3 + 00	568 ±	114.60	16.6	98.25	94.1	25.0	104.4
D-16	3 + 50	568 ±	113.40	16.0	97.70	94.1	25.0	103.8
7/8/75								
D-17	0 + 25	Cradle for Pipe	113.00	19.9	94.25	94.1	25.0	100.0
D-18	0 + 65	"	113.40	19.4	95.00	94.1	25.0	100.9
D-19	1 + 10	"	113.70	20.3	94.55	94.1	25.0	100.5
D-20	1 + 40	"	113.20	20.2	94.20	94.1	25.0	100.0

Richard C. Anderson
Director: Technical Services

SOIL CONSULTANTS, INC.

MERRIFIELD, VIRGINIA 22116

Job No. 4884

Date July 14, 1

RESULTS OF IN-PLACE DENSITY TESTS

Project: WHEATLANDS DAM SITE

Location: Fredrick Co., Virginia

Tested For: Glaize Development, Inc.

ASTM-D-698-70 C Method

TEST NO.	LOCATION	ELEVATION	WET DENSITY PCF	PERCENT MOISTURE	DRY DENSITY PCF	MAXIMUM LAB DRY DENSITY PCF	OPTIMUM MOISTURE PERCENT	PERCENT COMPACTION
7/9/75								
D-21	0 + 25	3' Above Cradle	121.95	12.0	108.80	106.4	18.0	102.3
D-22	0 + 65	"	121.60	13.2	107.45	106.4	18.0	100.9
D-23	1 + 10	"	121.50	12.7	107,85	106.4	18.0	101.4
D-24	1 + 40	"	121.80	12.6	108.20	106.4	18.0	101.7
D-25	0 + 25	2' Over Pipe	120.00	14.2	105.10	106.4	18.0	98.7
D-26	0 + 65	"	120.60	14.4	105.45	106.4	18.0	99.0
D-27	1 + 10	"	119.50	14.8	104.10	106.4	18.0	97.8
D-28	1 + 40	"	119.10	14.7	103.85	106.4	18.0	97.6

Richard C. Anderson
Director: Technical Services

SOIL CONSULTANTS, INC.

MERRIFIELD VIRGINIA 22116

Job No. 1334

Date July 14,

RESULTS OF IN-PLACE DENSITY TESTS

Project: WHEATLANDS DAM SITE

Location: Fredrick Co., Virginia

Developer: Glaize Development, Inc.

ASTM-D-698-70 C Method

TEST NO.	LOCATION	ELEVATION	WET DENSITY PCF	PERCENT MOISTURE	DRY DENSITY PCF	MAXIMUM LAB DRY DENSITY PCF	OPTIMUM MOISTURE PERCENT	PERCEN COMPAC TION
7/9/75								
D-21	0 + 25	3' Above Cradle	121.95	12.0	108.80	106.4	18.0	102.3
D-22	0 + 65	"	121.60	13.2	107.45	106.4	18.0	100.9
D-23	1 + 10	"	121.50	12.7	107,85	106.4	18.0	101.4
D-24	1 + 40	"	121.80	12.6	108.20	106.4	18.0	101.7
D-25	0 + 25	2' Over Pipe	120.00	14.2	105.10	106.4	18.0	98.7
D-26	0 + 65	"	120.60	14.4	105.45	106.4	18.0	99.0
D-27	1 + 10	"	119.50	14.8	104.10	106.4	18.0	97.8
D-28	1 + 40	"	119.10	14.7	103.85	106.4	18.0	97.6

Richard C. Anderson
Director: Technical Services

APPENDIX V

POST-CONSTRUCTION STUDY

LAW ENGINEERING ASSOCIATES OF VIRGINIA
Geotechnical and Materials Engineers
P. O. DRAWER OO / 7913 WESTPARK DRIVE / McLEAN, VIRGINIA, 22101 / (703) 790-6700

November 21, 1980

U. S. Army Engineer District
Geotechnical Engineering Section
803 Front Street
Norfolk, Virginia 23510

ATTENTION: Mr. David A. Pezza, P. E.
Chief Engineer

SUBJECT: Information Pertaining to Wheatlands Dam
LETCO Project No. W-0-2982

Dear Mr. Pezza:

In regards to our telephone conversation of November 19, 1980, we are sending you the enclosed information. Mr. Fred Glaize, III, has authorized us to send selected appendices to our 1976/77 study of the dam. The appendices which we have been authorized to release include the boring logs and the laboratory test data. He has also authorized us to send copies of field test results conducted by, and letters written by Soil Consultants, Inc. during construction of the dam in 1975.

If you have any questions regarding this information, or if we can be of further assistance, please contact us.

Very truly yours,

LAW ENGINEERING ASSOCIATES OF VIRGINIA

Harold W. Van Aller

Herald W. Van Aller
Geotechnical Engineer

John S. Jones, Jr., P. E.
Chief Engineer
General Partner

cc Mr. Fred Glaize

1262

3.4 Groundwater

The elevation of the reservoir at the time of our investigation was approximately +599 MSL. Water level readings were recorded in sealed observation wells located in the soil test borings. The water level in these casings were monitored during our field operations and prior to our field permeability tests. Water level readings are shown in Table I.

TABLE I

WATER LEVEL READINGS

Elevations in Feet, MSL

Boring No.	12-20-76	12-23-76	12-30-76	1-4-77
B1	-	Dry	Dry	Dry
B2	-	591.8	592.7	592.0
B3	587.0	588.9	591.4	591.0
B4	-	-	597.2	596.6

Estimated water levels through the dam are shown on Drawing 2, ~~Appendix~~ A.

APPENDIX A

TEST BORING RECORD

APPROX. ELEV.	STRATUM DEPTH	VISUAL SOIL DESCRIPTION	D	SR	K	N or CR	S	REMARKS
626	0.0							
625		FILL, brown and gray clayey silt and silty gravel, trace of sand and shale fragments	2	10		22		
			4.5	10		17		
620			7	11		13		
			9.5	6		6		
615								
			14.5	10		26		
610								
			19.5	13		14		
605								
			24.5	13		23		
600								
			29.5	15		31		
595								
	33.5	Brown and green decomposed SHALE	34.5	10		100/8"		
590								
	40.0		39.5	15		100/9"		
585		Boring Terminated @ 40.0', 12-10-76						NOTE: Piezometer installed to depth of 17.0'.

K - Soil Symbols

D - Sample Depths

N - Penetration in blows per foot (ASTM D-1586)

CR - % Core Recovery, NX or BX designates bit size (ASTM D-2113)

N or CR

5
18
22
70
NX
100
BX

SR - Sample Spoon Recovery in inches

18
12
14
18

S - Symbols Described Below

- Undisturbed Sample (ASTM D-1587)
- Water Level, time of boring
- Water Level
- Loss of Water
- C Caved Depth of Boring

Page 1 of 1

BORING NUMBER: B-1

DATE DRILLED: 12-10-76

JOB NUMBER: W-6-1487

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 1+00

TEST BORING RECORD

APPROX. ELEV.	STRATUM DEPTH	VISUAL SOIL DESCRIPTION	D	SR	K	N or CR	S	REMARKS
626	0.0							
625		FILL, brown and gray decomposed shale and silty clay	1	10		54		
620	6.5		6	12		28		
		FILL, light brown clayey silt and silty gravel with shale fragments and trace of fine sand						
615			11	14		18		
610			16	14		24		
605			21	16		17		
600			26	10		14		
595			31	8		22		
								34.2', 12-23-76
590			36	12		15		-
585			41	9		49		
580			46	10		17		
	49.0	See Page 2						

Continued on Page 2

K - Soil Symbols

D - Sample Depths

N - Penetration in blows per foot (ASTM D-1586)

CR - % Core Recovery, NX or BX designates bit size (ASTM D-2113)

N or CR

SR - Sample Spoon Recovery in inches

S - Symbols Described Below

- Undisturbed Sample (ASTM D-1587)
- Water Level, time of boring
- Water Level
- Loss of Water
- C: Caved Depth of Boring

BORING NUMBER: B-2

DATE DRILLED: 12-21-76

JOB NUMBER: W-6-1487

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 2+00

TEST BORING RECORD

APPROX. ELEV.	STRATUM DEPTH	VISUAL SOIL DESCRIPTION	D	SR	K	N or CR	S	REMARKS
576	50.0	Continued from Page 1						
575		Very stiff orange and brown silty CLAY with some shale fragments (CL) (Possible Fill)	51	9		29		
570	55.0	Medium hard to hard fractured gray SHALE	55	0		100 NX 13% RQD	• $\frac{100}{1"}$	
565	60.0	Boring Terminated @ 60.0', 12-22-76						
560								NOTE: Piezometer installed to depth of 60.0'.

K - Soil Symbols

D - Sample Depths

N - Penetration in blows per foot (ASTM D-1586)

CR - % Core Recovery, NX or BX designates bit size (ASTM D-2113)

N or CR: 5 / 18 / 22 / 70 NX / 100 BX

SR - Sample Spoon Recovery in inches: 18 / 12 / 14 / 18

S - Symbols Described Below

- Undisturbed Sample (ASTM D-1587)
- Water Level, time of boring
- Water Level
- Loss of Water
- C — Caved Depth of Boring

BORING NUMBER: B-2

DATE DRILLED: 12-21-76

JOB NUMBER: W-6-1487

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 2+00

TEST BORING RECORD

APPROX. ELEV.	STRATUM DEPTH	VISUAL SOIL DESCRIPTION	D	SR	K	N or CR	S	REMARKS
+626	0.0							
625		FILL, brown and gray silty gravel, clayey silt, trace of fine sand and shale fragments (dry)	3	14		32		
620			6	13		38		
			8	14		21		
615			11	13		14		
610			16	14		13		
605								20.0' 24" Recovery 22.0'
			23	15		15		
600	25.0	FILL, brown clayey silt, trace of gravel	26	15		20		
595	30.0	FILL, brown silty gravel with clayey silt, trace of sand and shale fragments	31	15		16		
590			36	14		20		37.1', 12-23-76
585			41	14		24		NOTE: (1) Hole dry at time of boring. (2) Piezometer installed to a depth of 39 feet.
580	47.0	Boring Terminated @ 47.0', 11-25-76	46	13		23		

K - Soil Symbols

D - Sample Depths

N - Penetration in blows per foot (ASTM D-1586)

CR - % Core Recovery, NX or BX designates bit size (ASTM D-2113)

N or CR: 8, 18, 22, 70 NX, 100 BX

SR - Sample Spoon Recovery in inches: 18, 12, 14, 18

S - Symbols Described Below

- Undisturbed Sample (ASTM D-1587)
- Water Level, time of boring
- Water Level
- Loss of Water
- C - Caved Depth of Boring

Page 1 of 1

BORING NUMBER: B-3

DATE DRILLED: 11-25-76

JOB NUMBER: W-6-1487

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 2+96

TEST BORING RECORD

APPROX ELEV.	STRATUM DEPTH	VISUAL SOIL DESCRIPTION	D	SR	K	N or CR	S	REMARKS
626	0.0							
625		FILL, brown and gray clayey silt and silty gravel, with shale fragments	2	12		14		
			4.5	18		23		
620			7	12		15		
	8.5	FILL, gray and black weathered shale	9.5	5		69		
615								
	13.0	FILL, brown and green silty gravel and clayey silt with shale fragments and organics	14.5	12		27		
610								
			19.5	6		33		20.5'
605								17" Recovery
								22.5'
			23.5	13		22		
600								
	28.0	FILL, light brown clayey silt and silty gravel with shale fragments	29.5	13		16		
595								
			34.5	13		17		35.5'
590								24" Recovery
								37.5'
			38.5	18		18		
585								
			44.5	12		9		
580								
			49.5	14		18		

Continued on Page 2

K - Soil Symbols

D - Sample Depths

N - Penetration in blows per foot (ASTM D-1586)

CR - % Core Recovery, NX or BX designates bit size (ASTM D-2113)

N or CR

5	
16	18
22	
	12
70	
NX	14
100	
BX	18

SR - Sample Spoon Recovery in inches

S - Symbols Described Below

- Undisturbed Sample (ASTM D-1587)
- Water Level, time of boring
- Water Level
- Loss of Water
- C - Caved Depth of Boring

BORING NUMBER: B-4

DATE DRILLED: 12-9-76

JOB NUMBER: W-6-1487

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 4+00

TEST BORING RECORD

APPROX. ELEV.	STRATUM DEPTH	VISUAL SOIL DESCRIPTION	D	SR	K	N or CR	S	REMARKS
576	50.0'	Continued from Page 1						
575		FILL, light brown clayey silt and silty gravel with shale fragments						
	53.0							
		Very stiff orange and brown silty CLAY trace of shale fragments (CL) - (Possible Fill)	54.5	8		20		
570								
			59.5	10		16		
565								
	62.5							
		Soft to moderately hard gray SHALE						
560								
	68.0							
		Boring Terminated @ 68.0', 12-9-76						NOTE: Piezometer installed to depth of 36.0'.
555								

K - Soil Symbols

D - Sample Depths

N - Penetration in blows per foot (ASTM D-1586)

CR - % Core Recovery, NX or BX designates bit size (ASTM D-2113)

N or CR

5
18
22
70
NX
100
BX

SR - Sample Spoon Recovery in inches

18
12
14
18

S - Symbols Described Below

- Undisturbed Sample (ASTM D-1587)
- Water Level, time of boring
- Water Level
- Loss of Water
- C - Caved Depth of Boring

BORING NUMBER: B-4

DATE DRILLED: 12-9-76

JOB NUMBER: W-6-1487

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 4+00

TEST PIT RECORD

APPROX. ELEV. (Ft.)	STRATUM DEPTH (Ft.)	VISUAL SOIL DESCRIPTION	REMARKS
598	1.0	TOPSOIL	
		FILL, brown silty clay and clayey silt with coarse shale fragments	
595			
590	8.0		NOTE: Jar sample @ 8.0'. Test Pit dry at time of excavation.
			SIZE OF TEST PIT: 2'X 10'
			ORIENTATION OF TEST PIT: NORTH–SOUTH

NOTES:

- Water level as noted
- Water level at time of excavation
- q_p Hand Penetrometer Test (TSF)
- T.V. Torvane Test (TSF)
- F.D. Field Density Test (Ft.)

Method of Excavation: Backhoe

TEST PIT NUMBER: TP-1

DATE EXCAVATED: 12-20-76

JOB NUMBER: W-6-1487

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 1+00

TEST PIT RECORD

APPROX. ELEV. (Ft.)	STRATUM DEPTH (Ft.)	VISUAL SOIL DESCRIPTION	REMARKS
595	1.0	TOPSOIL	
		FILL, brown sandy silty clay with coarse shale and organics	
590			
	8.0		NOTE: Jar sample at 8.0'. Test pit dry at time of excavation.
586			
			SIZE OF TEST PIT: 2' X 10'
			ORIENTATION OF TEST PIT: NORTH-SOUTH

NOTES:

- Water level as noted
- Water level at time of excavation
- q_p Hand Penetrometer Test (TSF)
- T.V. Torvane Test (TSF)
- F.D. Field Density Test (Ft.)
- Method of Excavation: Backhoe

TEST PIT NUMBER: TP-2

DATE EXCAVATED: 12-20-76

JOB NUMBER: W-6-1487

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 2+00

TEST PIT RECORD

APPROX. ELEV. (Ft.)	STRATUM DEPTH (Ft.)	VISUAL SOIL DESCRIPTION	REMARKS
568			
	1.0	TOPSOIL	
		FILL, brown silty clay and clayey silt, trace of gravel	
560			
555	8.0		NOTE: Jar sample @ 8.0'
			SIZE OF TEST PIT: 2' x 10'
			ORIENTATION OF TEST PIT: NORTH-SOUTH

NOTES:

- Water level as noted
- Water level at time of excavation
- Hand Penetrometer Test (TSF)
- T.V. Torvane Test (TSF)
- P.D. Field Density Test (Ft.)
- Method of Excavation: Backhoe

TEST PIT NUMBER: TP-3

DATE EXCAVATED: 12-20-76

JOB NUMBER: W-6-1487

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 3+00

TEST PIT RECORD

APPROX. ELEV. (Ft.)	STRATUM DEPTH (Ft.)	VISUAL SOIL DESCRIPTION	REMARKS
560	1.0	TOPSOIL	
		FILL, brown silty clay	▽ 2.0'
555	5.0	Brown silty CLAY with shale fragments	
	8.0		NOTE: Jar Sample @ 8.0'
545			
			SIZE OF TEST PIT: 2' X 10'
			ORIENTATION OF TEST PIT: NORTH-SOUTH

NOTES:

▽ Water level as noted

▽ Water level at time of excavation

q_p Hand Penetrometer Test (TSF)

T.V. Torvane Test (TSF)

F.D. Field Density Test (Ft.)

Method of Excavation: Backhoe

TEST PIT NUMBER: TP-4

DATE EXCAVATED: 12-20-76

JOB NUMBER: W-6-1467

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 3+00

TEST PIT RECORD

APPROX. ELEV. (Ft.)	STRATUM DEPTH (Ft.)	VISUAL SOIL DESCRIPTION	REMARKS
575			
	1.0	TOPSOIL	
		FILL, light brown silty clay, trace of shale and organics	Undisturbed sample at 3.0'
570			
	8.0		NOTE: Test pit dry at time of excavation
565			
			SIZE OF TEST PIT: 2' X 10'
			ORIENTATION OF TEST PIT: NORTH–SOUTH

NOTES:

Water level as noted

Water level at time of excavation

q_p Hand Penetrometer Test (TSF)

T.V. Torvane Test (TSF)

F.D. Field Density Test (Ft.)

Method of Excavation: Backhoe

TEST PIT NUMBER: TP-5

DATE EXCAVATED: 12-20-76

JOB NUMBER: W-6-1487

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 4+00

TEST PIT RECORD

APPROX. ELEV. (Ft.)	STRATUM DEPTH (Ft.)	VISUAL SOIL DESCRIPTION	REMARKS
570	0.5	TOPSOIL	0.5'
		FILL, brown silty clay, trace of shale fragments	
565			
	8.0		NOTE: Jar sample at 8.0'
560			
			SIZE OF TEST PIT: 2' X 10'
			ORIENTATION OF TEST PIT: NORTH-SOUTH

NOTES:

- Water level as noted
- Water level at time of excavation
- q_p Hand Penetrometer Test (TSF)
- T.V. Torvane Test (TSF)
- F.D. Field Density Test (Ft.)
- Method of Excavation: Backhoe

TEST PIT NUMBER: TP-4

DATE EXCAVATED: 12-20-76

JOB NUMBER: W-6-1487

WHEATLANDS DAM
DOUBLE TOLL GATE, VIRGINIA
STATION 4+00

APPENDIX B

LAW ENGINEERING TESTING COMPANY

SOIL DATA SUMMARY

BORING NO.	BORING DEPTH	SAMPLE TYPE	SOIL CLASSIFICATION	UNIT WEIGHT PCF		% FINER NO. 200 SIEVE	SPECIFIC GRAVITY	VOID RATIO	NATURAL MOISTURE %	ATTERBERG LIMITS			ADDITIONAL TESTS CONDUCTED (SEE NOTE 3)
				Wet	Dry					L.L.	P.L.	P.I.	
B-1	18.5-20.0	SS				51.0			30.6				
B-1	23.5-25	SS							15.5				
B-1	28.5-30	SS							26.6				
B-3	20-22	UD	GM A-6(3)	123.1	101.3	46.9	2.71	.669	21.5	39	25	14	T
B-3	25-26.5	SS	ML A-7-5(4)			51.9	2.63		22.2	42	30	12	
B-3	30-31.5	SS	GM A-2-7(0)			28.8	2.68		20.2	42	30	12	
B-4	20.5-22.5	UD	GM A-2-4(0)	133.1	114.2	35.1	2.72	.486	16.5	37	27	10	
	35.5-37.5	UD		134.0	115.7	22.6			15.8				
B-2	20-21.5	SS				59.9							

NOTES:
1. Soil tests in accordance with applicable ASTM Standards
2. Soil classification in accordance with Unified Soil Classification System
3. T = Triaxial Test Results
   U = Unconfined Compression Test Results
   C = Consolidation Test Results
   P = Proctor Test Results
   HP = Hand Penetrometer Test Results
   TV = Torvane Test Results

PROJECT NAME Wheatlands Dam

PROJECT NUMBER W-6-1487

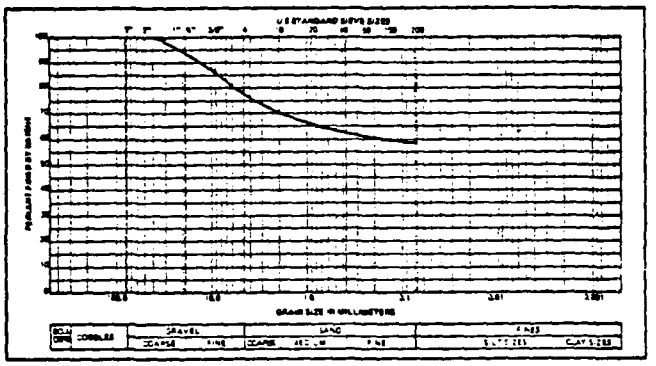
PROJECT LOCATION Frederick County, Virginia

LETCO SOIL DATA REPORT SHEET

SOIL PROPERTIES FOR WHEATLANDS DAM NO-1467
BORING NUMBER = B-2
SAMPLE IDENTIFICATION = SS @ 20.0-21.5 FT.

SIEVE ANALYSIS

SIEVE NUMBER	#CUM WT RETAINED	PERCENT FINER
32	0.	100.0
34	11.8	93.3
36	23.3	86.7
4	37.3	78.4
10	51.2	70.8
20	60.5	65.5
40	65.0	62.9
60	67.3	61.3
100	69.3	60.5
200	70.4	59.9



PERCENTAGE CLASSIFICATION IS
21.6% GRAVEL 18.6% SAND 59.9% FINES

LAW ENGINEERING TESTING COMPANY

AD-A103 510 ARMY ENGINEER DISTRICT NORFOLK VA F/G 13/13
NATIONAL DAM SAFETY PROGRAM. WHEATLANDS DAM (INVENTORY NUMBER V--ETC(U)
OCT 80 J A WALSH

UNCLASSIFIED NL

2 OF 2
AD A
103510

END
DATE FILMED
10-81
DTIC

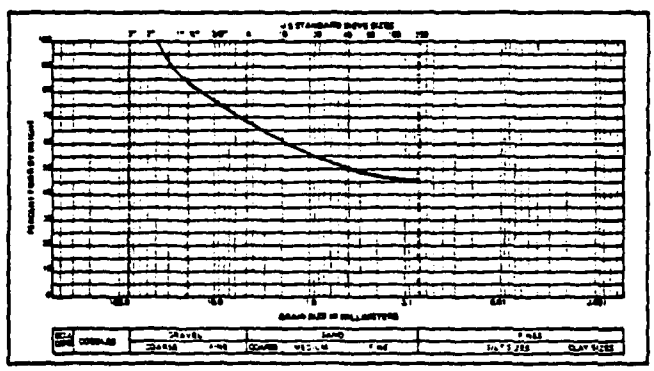
LETCO SOIL DATA REPORT SHEET

SOIL PROPERTIES FOR WHEATLANDS DAM No-1457
BORING NUMBER = B-3
SAMPLE IDENTIFICATION = UD @ 20-22 FT.

SPECIFIC GRAVITY = 2.71
WET UNIT WEIGHT = 123.1 PCF
NATURAL MOISTURE CONTENT = 21.5 PERCENT
DRY UNIT WT =101.3 PCF VOID RATIO = 0.669 PERCENT SAT.= 87.1

SIEVE ANALYSIS

SIEVE NUMBER	#CUM WT RETAINED	PERCENT FINER
32	0.	100.0
34	24.1	82.5
36	33.7	75.5
4	40.8	70.3
10	49.1	64.3
20	58.1	57.7
40	65.4	52.4
60	69.9	49.1
100	71.8	47.7
200	73.0	46.9



PLASTICITY PROPERTIES OF MAT. PASSING NO. 40 SIEVE

PLASTIC LIMIT IS 25
LIQUID LIMIT IS 39
PLASTICITY INDEX IS 14
LIQUIDITY INDEX = -0.29
PI/A-LINE PI IS = 0.97

APPROX. SOIL PROP. BASED ON ABOVE DATA AND EMPIRICAL RELATIONSHIPS

COMPRESSION INDEX (CC) IS 0.20
EFFECTIVE PHI ANGLE IS 33 + OR - 4 DEGREES
STAND PROCTOR OPT MOISTURE IS 20.0 %
STAND PROCTOR MAX DENSITY IS 102.0 PCF

PERCENTAGE CLASSIFICATION IS
29.7% GRAVEL 23.4% SAND 46.9% FINES

UNIFIED SOIL CLASSIFICATION IS
GM SILTY GRAVEL

AASHO SOIL CLASSIFICATION IS
A-6 WITH GROUP INDEX OF 3 CLAYEY SOILS

LAW ENGINEERING TESTING COMPANY

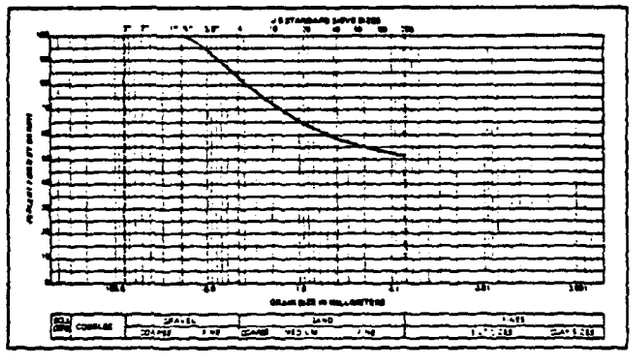
LETCO SOIL DATA REPORT SHEET

SOIL PROPERTIES FOR WHEATLANDS DAM NO-1487
BORING NUMBER = B-3
SAMPLE IDENTIFICATION = SS @ 25.0-26.5 FT.

SPECIFIC GRAVITY = 2.63
NATURAL MOISTURE CONTENT = 22.0 PERCENT

SIEVE ANALYSIS

SIEVE NUMBER	%CUM WT RETAINED	PERCENT FINER
34	0.	100.0
30	0.6	99.3
4	10.4	89.3
10	27.3	71.7
20	35.3	64.1
40	40.0	59.3
60	42.8	56.5
100	45.3	54.0
200	47.3	51.9



PLASTICITY PROPERTIES OF MAT. PASSING NO. 40 SIEVE

PLASTIC LIMIT IS	30
LIQUID LIMIT IS	42
PLASTICITY INDEX IS	12

LIQUIDITY INDEX = -0.65
PI/A-LINE PI IS = 0.75

APPROX. SOIL PROP. BASED ON ABOVE DATA AND EMPIRICAL RELATIONSHIPS

COMPRESSION INDEX (CC) IS 0.28
EFFECTIVE PHI ANGLE IS 33 + OR - 4 DEGREES
STAND PROCTOR OPT MOISTURE IS 22.2 %
STAND PROCTOR MAX DENSITY IS 99.8 PCF

PERCENTAGE CLASSIFICATION IS
10.7% GRAVEL 31.4% SAND 51.9% FINES

UNIFIED SOIL CLASSIFICATION IS
ML

AASHO SOIL CLASSIFICATION IS
A-7-5 WITH GROUP INDEX OF 4 CLAYEY SOILS

LAW ENGINEERING TESTING COMPANY

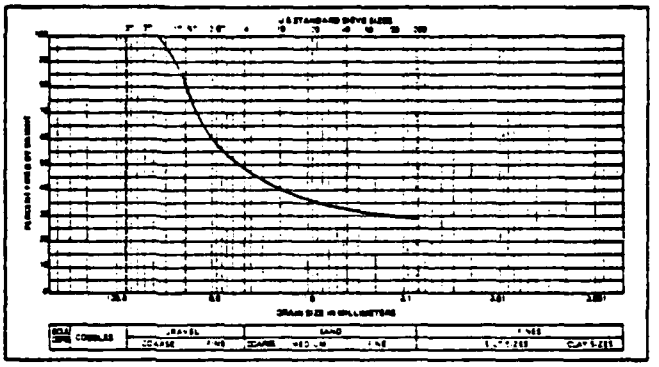
LETCO SOIL DATA REPORT SHEET

SOIL PROPERTIES FOR WHEATLANDS DAm No-1487
BORING NUMBER = B-3
SAMPLE IDENTIFICATION = SS @ 30.0-31.5 FT.

SPECIFIC GRAVITY = 2.66
NATURAL MOISTURE CONTENT = 20.2 PERCENT

SIEVE ANALYSIS

SIEVE NUMBER	%CUM WT RETAINED	PERCENT FINER
32	0.	100.0
34	21.2	79.1
36	43.4	57.2
4	51.6	49.1
10	60.0	40.8
20	65.5	35.3
40	68.0	32.9
60	69.9	31.0
100	71.0	29.9
200	72.1	28.8



PLASTICITY PROPERTIES OF MAT. PASSING NO. 40 SIEVE

PLASTIC LIMIT IS	30
LIQUID LIMIT IS	42
PLASTICITY INDEX IS	12

LIQUIDITY INDEX = -0.65
PI/A-LINE PI IS = 0.73

APPROX. SOIL PROP. BASED ON ABOVE DATA AND EMPIRICAL RELATIONSHIPS

COMPRESSION INDEX (CC) IS 0.29
EFFECTIVE PHI ANGLE IS 33 + OR - 4 DEGREES
STAND PROCTOR OPT MOISTURE IS 22.3 %
STAND PROCTOR MAX DENSITY IS 99.6 PCF

PERCENTAGE CLASSIFICATION IS
50.9% GRAVEL 20.2% SAND 28.8% FINES

UNIFIED SOIL CLASSIFICATION IS
GM SILTY GRAVEL

AASHO SOIL CLASSIFICATION IS
A-2-7 WITH GROUP INDEX 0

LAW ENGINEERING TESTING COMPANY

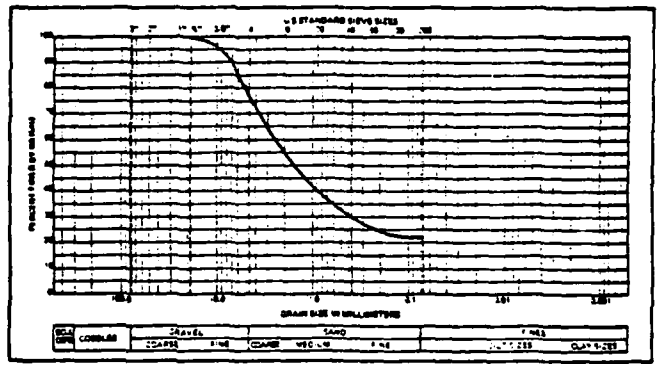
LETCO SOIL DATA REPORT SHEET

SOIL PROPERTIES FOR WHEATLANDS DAM NO-1467
BORING NUMBER = B-4
SAMPLE IDENTIFICATION = SS @ 35.5-37.5 FT.

WET UNIT WEIGHT = 134.0 PCF
NATURAL MOISTURE CONTENT = 15.8 PERCENT

SIEVE ANALYSIS

SIEVE NUMBER	%COM RT RETAINED	PERCENT FINER
34	0.	100.0
36	3.8	96.2
4	23.2	76.5
10	46.3	53.2
20	61.0	38.3
40	67.5	31.7
60	71.9	27.3
100	74.7	24.5
200	76.5	22.6



PERCENTAGE CLASSIFICATION IS
23.5% GRAVEL 53.9% SAND 22.6% FINES

LAW ENGINEERING TESTING COMPANY

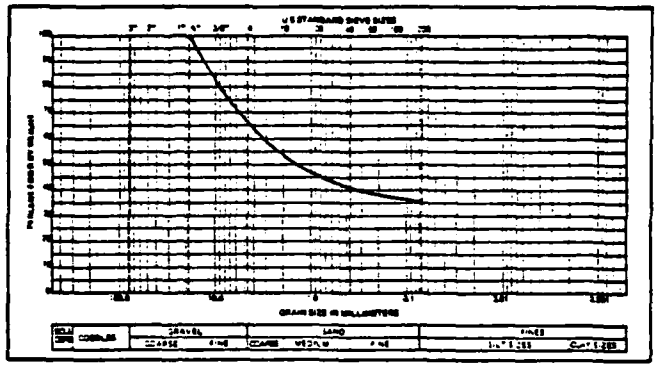
LETCO SOIL DATA REPORT SHEET

SOIL PROPERTIES FOR WHEATLANDS DAM NO-1487.
BORING NUMBER = B-4
SAMPLE IDENTIFICATION = UD @ 20.5-22.5 FT.

SPECIFIC GRAVITY = 2.72
WET UNIT WEIGHT = 133.1 PCF
NATURAL MOISTURE CONTENT = 16.5 PERCENT
DRY UNIT WT =114.2 PCF VOID RATIO = 0.466 PERCENT SAT.= 92.4

SIEVE ANALYSIS

SIEVE NUMBER	%CUM WT RETAINED	PERCENT FINER
34	0.	100.0
30	29.3	70.8
4	44.9	67.0
10	63.0	54.0
20	75.8	45.2
40	82.5	40.4
60	85.0	38.2
100	87.7	36.6
200	89.8	35.1



PLASTICITY PROPERTIES OF MAT. PASSING NO. 40 SIEVE

PLASTIC LIMIT IS 27
LIQUID LIMIT IS 37
PLASTICITY INDEX IS 10
LIQUIDITY INDEX = -0.97
PI/A-LINE PI IS = 0.84

APPROX. SOIL PROP. BASED ON ABOVE DATA AND EMPIRICAL RELATIONSHIPS

COMPRESSION INDEX (CC) IS 0.24
EFFECTIVE PHI ANGLE IS 33 + OR - 4 DEGREES
STAND PROCTOR OPT MOISTURE IS 20.5 %
STAND PROCTOR MAX DENSITY IS 103.1 PCF

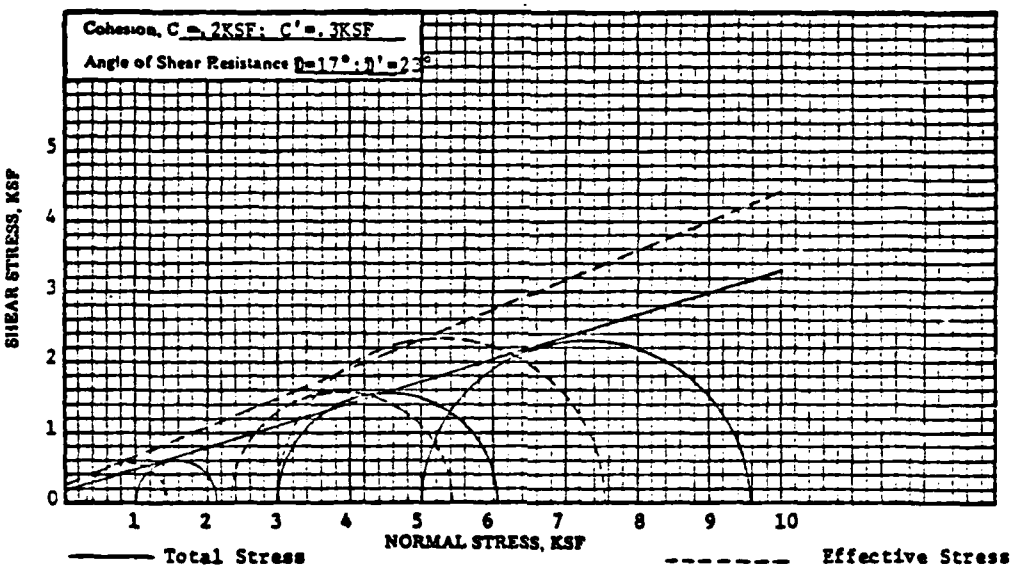
PERCENTAGE CLASSIFICATION IS
32.4% GRAVEL 32.4% SAND 35.1% FINES

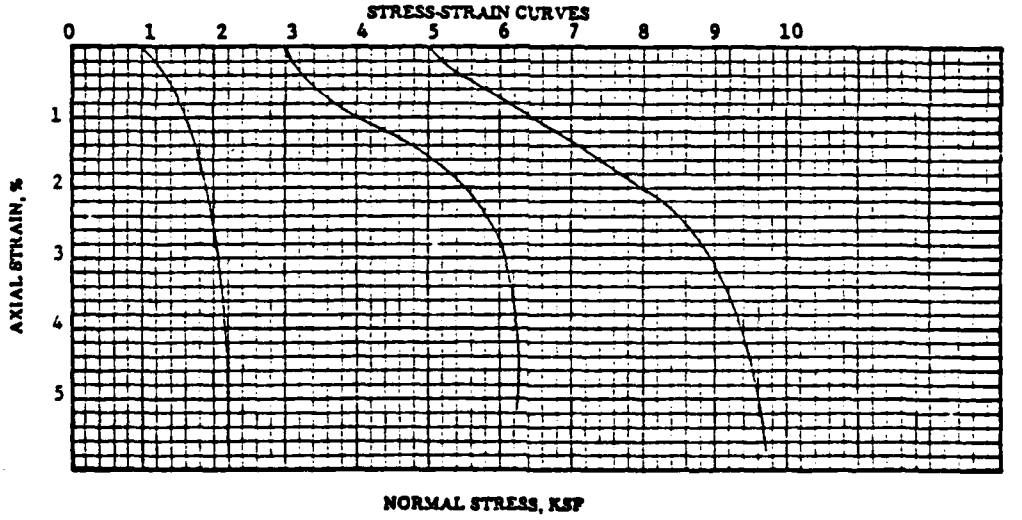
UNIFIED SOIL CLASSIFICATION IS
GM SILTY GRAVEL

AASHO SOIL CLASSIFICATION IS
A-2-4 WITH GROUP INDEX 0

LAW ENGINEERING TESTING COMPANY

MOHR DIAGRAM FOR FAILURE CONDITIONS





Soil Classification Brown Silty Gravel (GM)

SAMPLE NO.	(1)	(2)	(3)
Confining Pressure, ksf	1.0	3.0	5.0
Initial Length, in.	5.44	5.23	5.32
Initial Diameter, in.	2.68	2.63	2.68
Wet Unit Weight, pcf	124.7	124.2	120.5
Moisture Content, %	22.7	20.6	21.2
Initial Void Ratio	.664	.642	.700
Initial Percent Saturation, %	92.6	86.9	82.0

TRIAXIAL SHEAR TEST

Type of Test: Consolidated - Undrained

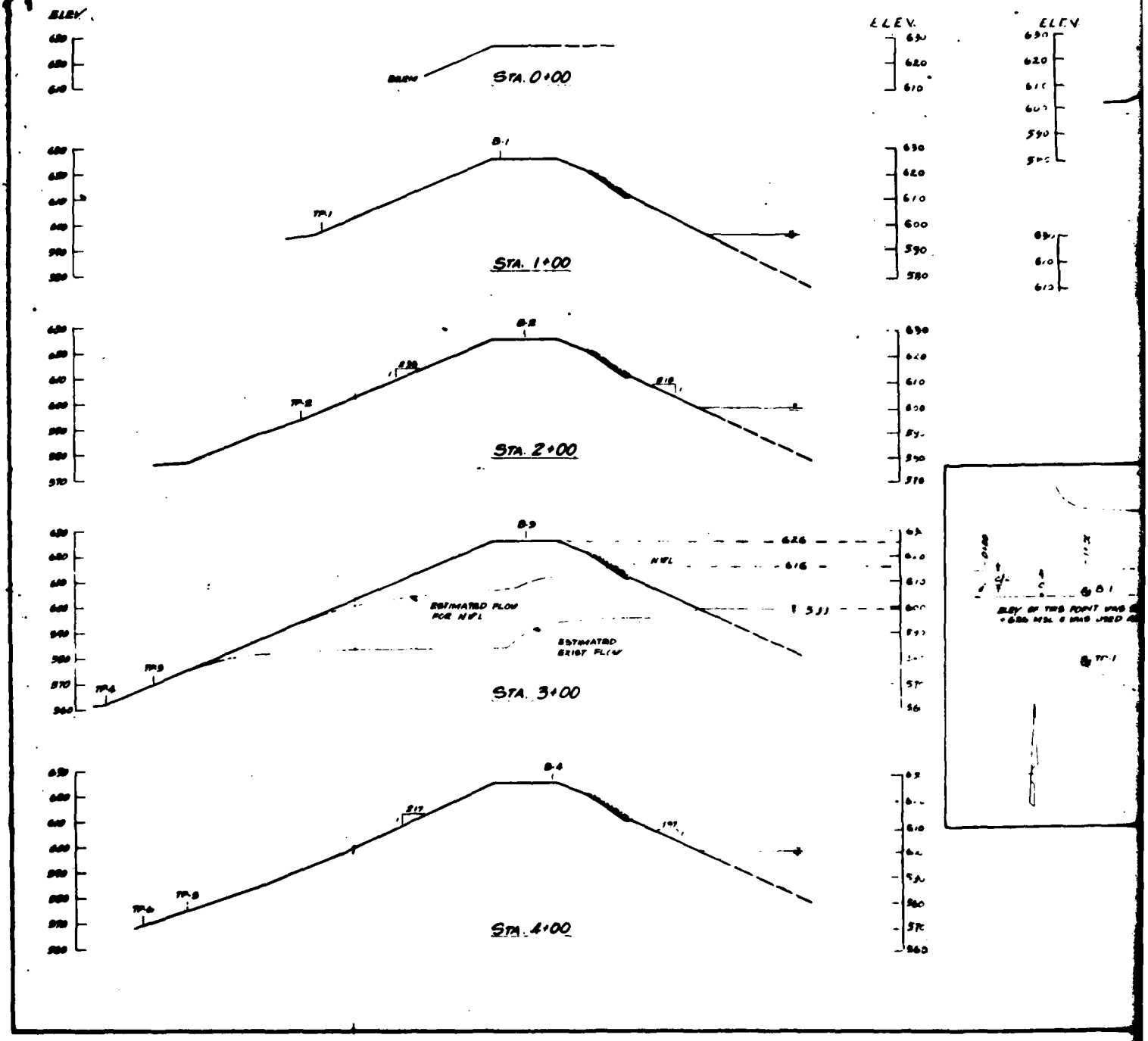
Type of Specimen: Undisturbed

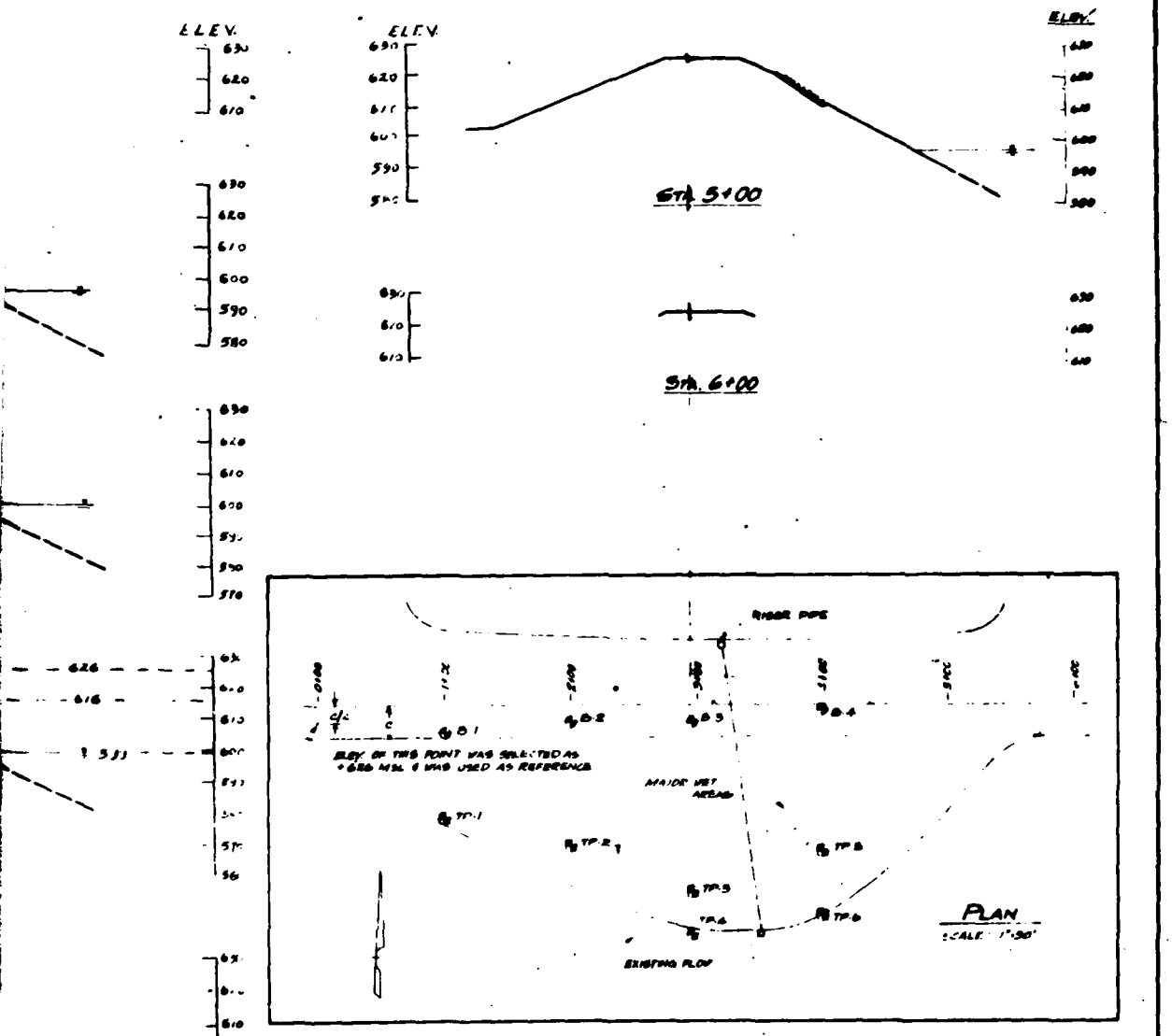
Rate of Shear: .003 in/min

Boring: B-3 Depth: 20 - 22 FT

Job No. W-6-1487 Date: Jan. 5, 1977

LAW ENGINEERING TESTING COMPANY


ELEV.
STA. 0+00
B-1
TP-1
STA. 1+00
B-2
TP-2
STA. 2+00
B-3
TP-3
TP-4
NWL
ESTIMATED FLOW FOR NWL
ESTIMATED BASE FLOW
STA. 3+00
B-4
TP-5
TP-6
STA. 4+00



LAW ENGINEERING TESTING COMPANY
SOILS, MATERIALS, AND FOUNDATIONS ENGINEERS
7813 WESTPARK DRIVE, MCLEAN, VIRGINIA 22101

As-Built Cross Sections & Boring Location Plan
Wheatland Earth Dam
Kyger's Toll Gate, VA

DRAWN BY:	DATE:	JOB NO. VA-1407
CHECKED BY:	SCALE: AS SHOWN	DRAWING NO. 2

1 2

APPENDIX VI

REFERENCES

APPENDIX VI

REFERENCES

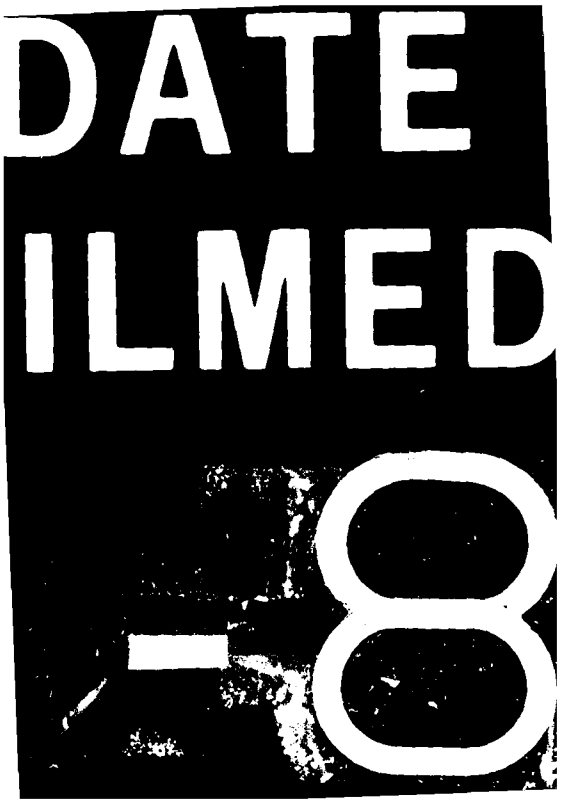
1. Recommended Guidelines for Safety Inspection of Dams, Office of the Chief of Engineers, Department of the Army, Washington, D. C.

2. HEC-1DB Flood Hydrograph Package, (Hydrologic Engineering Center, U. S. Army Corps of Engineers, September 1978.)

3. "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," Hydrometeorological Report No. 51, (U. S. Weather Bureau, June 1978).

4. "Rainfall Frequency Atlas of the Unites States", Technical Paper No. 40, (U.S. Weather Bureau, May 1961).

5. "Bulletin 80: Geology and Mineral Resources of Frederick County," Charles Butts and Raymond S. Edmonson, (Virginia Division of Mineral Resources, 1966).


DATE
ILMED
8